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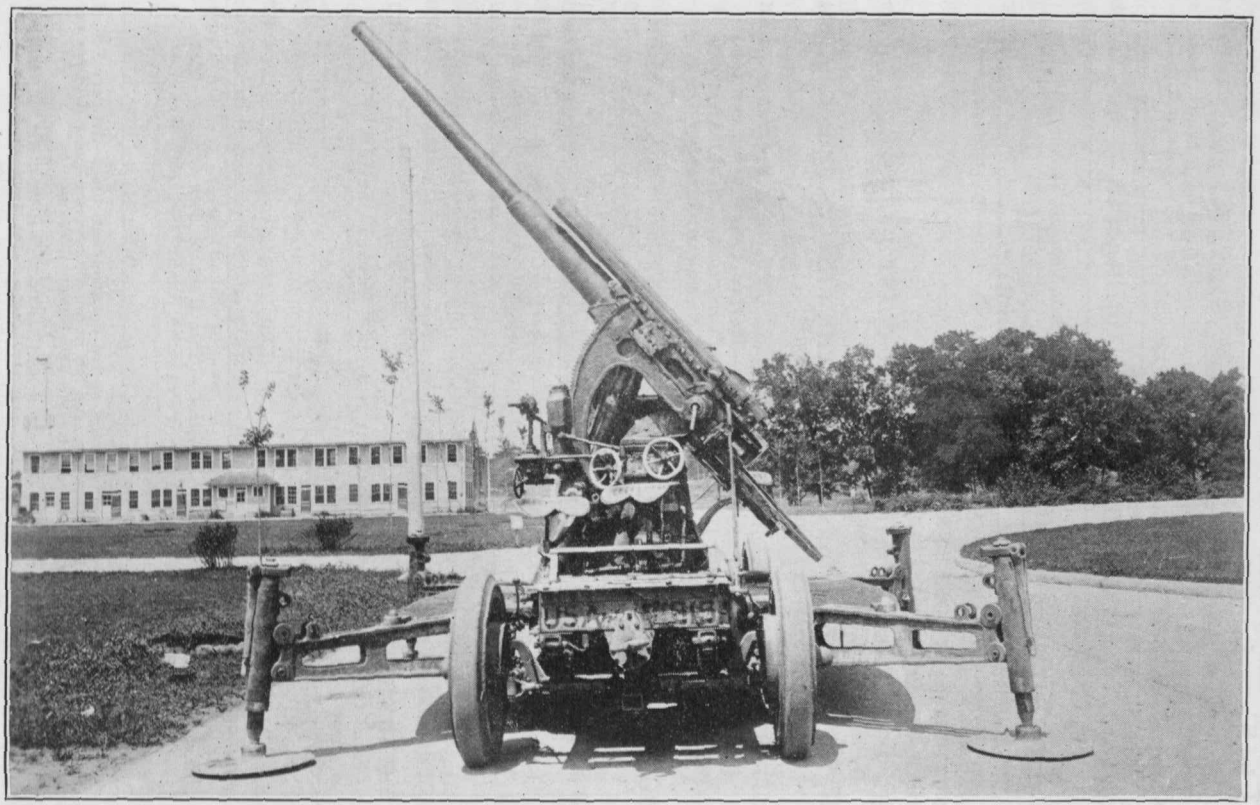

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THE COAST ARTILLERY JOURNAL

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Battle Training for Coast Artillery

By MAJOR E. J. CULLEN, C. A. C.

THE ultimate purpose of all military training is the development of battle efficiency. Target practice is but a form of military training that utilizes to advantage certain deep seated instincts common to all mankind. There is something in the human psychology, inherited perhaps from our cave-dwelling ancestors, that fills man with a keen desire to compete with his fellow-men in a test of skill in the use of weapons. This inherent urge of the individual is utilized to excellent advantage in the training of the soldier in the use of small arms. The soldier is encouraged and assisted to demonstrate his skill in competition with his fellow soldiers. But the primary purpose of this competition is to accomplish the training of the soldier, and the records of the competitors are of use merely as indications of the degree of training that has been accomplished. In other words target practice is primarily a means for the accomplishment of training rather than a test of the training accomplished. Another and even more important fact that should be borne in mind is that the development of individual proficiency is but the initial training necessary to prepare the soldier to play his proper part in the battle team, for team-work is the keynote of all battle efficiency, and battle efficiency is the ultimate purpose of all military training. The coast artillery officer readily realizes the importance of team work, for his every-day life is filled with the problems of "building up the team." But we of the C. A. C. should not limit our efforts solely to building up the "Battery Team," which is but a single unit in any artillery battle team. We must extend our efforts beyond the training of the battery units and strive to accomplish the training of the battle team as a team.

The battle efficiency of artillery is dependent upon two essential elements, namely, proficiency in fire technique and proficiency in fire tactics. Fire technique, frequently referred to as gunnery, is the technical operation of the fire units, the batteries. Fire tactics is the tactical employment of the combined fire power of these units.

In target practice we possess an opportunity for developing both the proficiency of the individual units in fire technique and the proficiency of the battle-team in fire tactics, that combination which is the basis of the battle efficiency of artillery. Coast artillery target practice should have for its purpose the development and test of proficiency in fire technique, and the development of proficiency in fire tactics. Furthermore, in order to insure the practicability and general effectiveness of the battle plans devised for use in the defense of a given locality, and in order to develop that team-work so essential to success in battle, there is need for a comprehensive program of progressive target practice for each harbor defense command. Such a program constitutes one of the principal means available for battle training. But the greatest handicap that could be encountered in battle training would be the lack of sufficient personnel and of sufficient ammunition. From the lack of sufficient personnel, we would be compelled to sacrifice certain measures which are essential in the fire action of modern battle. From the lack of sufficient ammunition we would be deprived of the opportunity of obtaining that volume of fire, the study of the effectiveness of which would afford a clear insight as to the deficiencies and inaccuracies of the various methods employed, both in fire technique and in fire tactics.

The first essential element of battle efficiency is that degree of proficiency in fire technique that will insure the complete and immediate effectiveness of the fire delivered against the designated target. Effectiveness of fire is the direct result of a volume of fire, delivered with precision against a designated objective during a given period of time. As a factor of effectiveness, volume of fire is related primarily to the character and size of the objective, but it also exercises a controlling influence upon the degree of precision that is attainable in that firing. Precision demands freedom from error, but the highest standard of accuracy possible in artillery fire-action is compelled to accept the presence of many indeterminate residual errors in the attendant operations. If precision is to be accomplished, the resultant effect of these indeterminate residual errors must be evaluated and the necessary compensation made. All accepted methods for the mathematical treatment of these indeterminate errors require the use of a reasonably reliable "mean value" obtained from the observation of actual results. The degree of precision that can be accomplished in the artillery fire-problem must depend, therefore, upon the volume of fire, since the number of shots that can be observed will exercise a direct influence upon the reliability of the "mean value" employed in the treatment of the indeterminate residual errors in the problem, and thereby upon the degree

of precision that can be accomplished. The relative reliability of "mean value" is as the square-root of the numbers of observations employed. The relative reliability of the "mean value" obtained from four observations is "2." In other words it may be stated that four observations will permit of a "mean value" that is twice as reliable for use in the treatment of indeterminate errors as is the value obtained from a single observation. It is generally accepted that four observations will afford a "mean value" that is reasonably reliable for artillery purposes. In testimony of this fact, we find the four-gun battery in general use by the artillery of most armies. This battery will deliver a salvo that affords four observations from which to evaluate the "mean value" of the effect of those indeterminate errors that are always present despite accurate preparation. With the heaviest calibers, where time and facilities are available for the most accurate preparation of firing data, it is possible to attain satisfactory precision of fire by the use of the two-gun salvo. But since the relative reliability of the "mean value" obtained from this salvo is less than that obtained from the four-gun salvo it may be expected that a greater number of salvos will be required to accomplish the same degree of precision as that attained by the four-gun battery, assuming of course equal accuracy in the preparation of firing data. The only reduction of ammunition allowance that is justifiable is that rather indefinite amount that may be saved through the employment of increased accuracy in the preparation of firing data for the heavy caliber batteries. It is generally accepted in artillery practice that four to nine salvos are required in order to positively accomplish a fair degree of precision of fire. In any case, unless the allowance of ammunition is sufficient to permit of the accomplishment of precision of fire, we shall have lost all opportunity of attaining a high degree of proficiency in fire technique.

In order to develop the necessary proficiency in fire tactics there must be an effective system of battle training that will include a progressive series of problems relating to the various situations that will be encountered in the execution of the approved battle plans for the general defense of the given locality. These problems must be free from all false assumptions and hypothetical conditions, that is to say, that in so far as possible, they must be based solely upon the actual conditions that would exist in battle. It is possible and highly desirable to utilize target practice as a means for the development of proficiency in fire tactics, by conducting a series of firing problems relating to tactical situations incident to the defense of a given locality. But these problems must be conducted with sufficient personnel to completely man every element of the command that

would be required to play a part in the action in actual battle. Furthermore, there must be sufficient ammunition available to insure conclusively the proper functioning of all the elements of the command involved in the action, the interferences that would be encountered, the cooperation that would be essential to success, and in general the actual results that would be accomplished in battle.

Today, with our present military policy of one Army, a team composed of the Regular Army, the National Guard, and the Organized Reserve, we are faced with the necessity of devising effective means for the training of that battle-team as a team. It is the team upon which the nation relies for success in war, and that success can be insured only through the development of maximum battle efficiency. The individual units that constitute this team must be equally proficient as elements of the team, and the team must be assembled and trained as a team, for that is the only possible method of developing team work, and team work is the keynote of battle efficiency. The time has arrived when we should consider changing from the present system by which we are now attempting to train separately the Regular Army, the National Guard and the Organized Reserves, each as a distinct entity within itself. We should devise some thoroughly coordinated system of battle training capable of developing the maximum battle efficiency of the complete battle-team assigned to the coast fortifications of each given locality. The required system must be designed to inculcate and develop the true spirit of cooperation and mutual reliance between component parts of the team, the Regulars, the National Guard, and the Reserves—that spirit which is most essential to the successful accomplishment of team work. Furthermore, this required system must be fully capable of developing the maximum proficiency in fire technique and fire tactics, and must provide a means for the thorough test of the battle plans adopted for the defense of each given locality. It is believed that all the facilities necessary for inaugurating and developing a battle training system of this scope and character, are made available by the authority now granted to Corps Area Commanders, the Chief of Coast Artillery, and the Chief of the Militia Bureau, under the provisions of paragraphs 33, 34, and 35, Training Regulations No. 10-5. The full and complete development of the battle efficiency of our harbor defense commands awaits the adoption of some system of combined battle-training for the component parts of the coast artillery of the Army.

The supervision of the training of all units of the Regular Army, National Guard, and Organized Reserve located within a given Corps area is vested in the Corps Area commander. One pos-

sible solution of the coast artillery battle training problem is to combine all the coast artillery organizations (fixed artillery, railway artillery, tractor artillery, and antiaircraft artillery of the three component branches) located within a given corps area, to constitute a unit battle team. This team could be trained each year for a definite project pertaining to the harbor defenses of a selected locality within the corps area, and this training could be conducted under the direct supervision of the coast artillery district commander, who as a staff officer, represents the corps area commander in all matters pertaining to coast artillery. By selecting each year as the basis of the training project a harbor defense command other than utilized the previous year, but within the same corps area, the entire coast defense problem, in so far as it pertains to coast artillery, could be covered within a reasonable time. Furthermore, it is believed that this change each year would serve to stimulate interest in the work entailed.

An annual training project for the utilization of the entire coast artillery personnel within the corps area for service at a specified harbor defense command, could be instituted in each coast artillery district. The extensive personnel available will permit of devising a training project based upon the employment of the complete war-strength organization of the selected harbor defense command. Ample personnel will be available for assignment to every element of the artillery defense in the selected locality; fixed batteries, mobile batteries, mines, searchlights, and communications; together with the commanders and staffs for the various sub-commands thereof. All organizations, both Regular Army and National Guard, could be given specific assignments in the designated harbor defense command. These assignments could be based upon the character of the organization, those pertaining to the fixed armament being assigned to various batteries in accordance with the type and caliber for which they have been previously trained. The mobile units, railway, tractor, and antiaircraft artillery should be assigned to the specific functions allotted to these classes of armament in the general defense plans of the selected locality. All available field and staff officers of the Regular Army and National Guard and all Reserve officers could be assigned to specific duties with the various units, staffs, and sub-commands of the designated harbor defense command, in accordance with their capabilities and the requirements of the battle organization. Similar assignments of the warrant officers and enlisted specialists could be made. Any individuals or units available after complete assignments have been made to each and every element of the designated harbor defense command, could be assigned as

alternates for specific duties with the various elements of the command. The definite assignment of each and every individual and unit would insure their proper training and preparedness to execute the functions required of them as members of the complete battle team.

The training program for the accomplishment of the annual training project should provide such special training of the various individuals and units as may be necessary to insure their maximum battle efficiency. The program should have for its ultimate object the development of a uniform high standard of proficiency of all individuals and organizations and it should prepare them in their proper functions as members of the battle team of the harbor defense command designated in the project. The program should provide for the training and preparation of all individuals and units at their home stations and armories throughout the entire year, and finally for the mobilization of the entire command at the designated locality in order to accomplish the battle training through a course of battle exercises.

At the home stations and armories provision should be made for the accomplishment of the special training of individuals and organizations that may be necessary to correct all previously demonstrated deficiencies and to develop a high standard of individual proficiency. This training should take the form of drill and instruction in the operation and maintenance of the armament and fire control equipment to which assigned, gunner's instruction, and sub-caliber firings. Special arrangements could be made for sub-caliber practices and night drills for National Guard organizations at nearby fortifications throughout the year, at times and places convenient to the personnel.

Special training should be provided in order to familiarize the personnel of each organization with all the details pertinent to the battery or other element of defense to which assigned in the training project. This training and instruction could be conducted at the home station or armory of the organization, and could be accomplished through the medium of lectures and the study of all the necessary maps, charts, diagrams, and photographs pertaining to the defense element to which assigned. Harbor boats and mine planters could be utilized throughout the year for the transportation of selected personnel of the various Regular, National Guard, and Reserve units for short visits to the designated localities. This would afford the opportunity of personal observation of the battery emplacements and other essential features of the local situation.

The special training of individuals and organizations with reference to the tactical employment of their battery or other assigned

element of the defense could be accomplished at the home stations and armories through the medium of the coast artillery war game or other suitable means. Conferences on the subject of the tactical functions and the employment of the assigned element in the various phases of the general defense of the designated locality could be conducted by specially trained officers designated by the coast artillery district commander.

Special training should be provided for all officers, Regular, National Guard, and Reserve, in addition to the training received with their organizations. For battery officers this special training should include a short course of instruction in the gunnery problems pertaining to their assigned type of armament and detailed instruction in the operation and maintenance of this materiel. For field and staff officers this special training should include instruction concerning the general and special defense plans, mobilization plans and battle plans pertaining to the locality designated in the training project, and their duties as commanders and staff officers in the various tactical situations therein. The instructors necessary for the special training of the officer personnel should be carefully selected and prepared for this duty, preferably under supervision of the coast artillery district commander. This class of instruction should be coordinated in the various commands, in order to conform to the local training programs and schedules. The keynote of successful battle training of coast artillery personnel is to be found in the careful and complete supervision and coordination of the training by group commanders, fort commanders, and harbor defense commanders.

The annual training program could be concluded by a complete mobilization and concentration, at the designated harbor defense command, of all the coast artillery personnel in the corps area (Regular Army, National Guard, and Organized Reserves). This mobilization could be utilized for the development of the team-work of the coast artillery battle team, and for the test of the battle plans adopted for the general defense of the selected locality. The program for the mobilization period could provide also for the thorough inspection of each element of these fortifications in order to insure the operating efficiency of the materiel, and the completeness of the equipment on hand. By suitable arrangement with the local naval-district commander, the cooperation of the naval patrol service in the selected locality might be obtained, which, together with the services of the available army air forces, would place the entire mobilization upon a complete war basis. Prior to mobilization day the harbor defense command designated in the annual project could be

placed in a complete state of readiness by the local garrison. All armament, fire control stations, searchlights, and all other elements of the defenses could be made ready for immediate service. The entire allowance of ammunition provided for the annual target practices of all Regular, National Guard and Reserve coast artillery units in the corps area, together with the necessary targets and towing vessels could be assembled at this place, available for use during the mobilization period. The necessary measures should be provided thereat to insure the complete and efficient administration and supply of the entire war-strength command. In other words, thorough preparation could be made, prior to mobilization day, to place the designated harbor defenses in full and immediate readiness for war.

The mobilization and the training of the assembled command could be conducted in accordance with a carefully prepared program instituted by the coast artillery district commander. The movements of all organizations, both fixed and mobile artillery (Regular, National Guard and Reserve), to the designated locality could be made in conformity with a definite prearranged plan designed to place the selected harbor defenses upon a complete war footing in case of emergency. The battle training of the assembled command during the mobilization period could be conducted in accordance with a program that would afford the exercises and the service firings necessary to develop proficiency in fire technique and in fire tactics.

The first week of the mobilization period could be devoted to the disciplinary training and special instruction of individuals; to the drills and tactical problems, involving sub-caliber firings, necessary for the development of team work in the various batteries, groups and forts; and to the conferences and lectures for all officers on the general defense plans and other matters relating to the battle efficiency of the command. Schools for enlisted specialists, for battery officers, and for field and staff officers, could be established for the review and test of their general training. By a carefully arranged schedule providing for short periods of intensive application, accompanied by proper periods for rest and recreation, a rather broad field of preparation could be covered in one week.

The second week of the mobilization period could be devoted to target practice. These practices should be grouped into two separate courses, a Gunnery Practice course for the development of proficiency in fire technique, and a Tactical course for the development of proficiency in fire tactics and for the test of the battle plans of the local defenses.

(1) *Gunnery Practice Course.*—This course conducted as a school of fire for all officers, could consist of a series of four firing problems. Each problem would involve the firing of a single battery, against a moving target. There could be one problem pertaining to mortars, one to primary guns, one to secondary guns, and one to antiaircraft guns. Each problem should consist of firing 6 to 12 salvos, and should be carefully prepared and outlined to the entire class before the practice opens. All available officers should be present at the firing battery to witness each practice. Provision could be made for the immediate display during the firing of each item of data employed, including reports of deviations of impacts, in order that the witnesses might observe and follow the computation of the firing data used for each salvo. All officers could be required to prepare the firing data computations at the time, and these solutions, made on suitable blank forms, should be submitted to the instructor at the close of the practice, for review. The firing should be executed by a designated organization, under the close supervision of its fire commander, and the personnel of all other organizations assigned to similar types of armament should be present, in order to gain familiarity with the conduct of the service firing. If desired, gun crews might be relieved by those from other organizations during the firings. The practice could be discontinued when the desired degree of precision of fire has been attained, this being indicated, for example, by two consecutive salvos "on target." Complete and accurate records could be maintained during the practice of all the data utilized in the firings, and a thorough analysis of the practice could be made immediately at the close thereof. The results of this analysis could be presented and discussed at a conference of all officers, held as soon as practicable after the close of each practice.

(2) *Tactical Course.*—Following the close of the gunnery practice course, a war condition period, lasting about 48 or 72 hours, could be inaugurated. This period could be devoted to the solution of a carefully prepared tactical problem, or series of problems, based upon the general defense plans for the given locality. Prior to the opening of this period all the necessary targets and towing vessels should be despatched to some suitable place outside the defense area, there to await until a designated time when they should then approach the given harbor in a stipulated formation and by a certain definite route, all in accordance with secret orders of the coast artillery district commander. With the opening of the war condition period, the naval patrol service and the army air forces could place the defense area and the seaward approaches thereto under constant surveillance, instituting the reconnaissance service

contemplated in the general defense plans. All batteries, stations, searchlights and other elements of the harbor defenses could be completely manned, relief details being made available to insure continuous effectiveness. The entire command should be placed, and maintained throughout, upon a complete status of "immediate readiness for action." If practicable, the services of other naval vessels might be obtained, to represent enemy vessels of similar classes, and these should accompany the targets in the approach to the defense area. These vessels would prove of valuable assistance for patroling the approaches of the firing area during the battle practice. The reconnoitering elements of naval patrol service and of the army air forces would report the approach of the targets, giving location, speed, direction of movement, formation, etc., and upon receipt of this information the batteries would prepare for action. The fire action would be opened as the targets entered the firing areas, and it should be conducted in conformity with the prepared battle plans adopted to meet that particular phase of the general defense. Each battery could be authorized sufficient ammunition for six salvos against each target to be taken under fire. By introducing the use of relief crews during prolonged phases of the battle practice, the maximum number of personnel could receive training. The entire fire action of the command could be conducted under battle conditions, and by the careful preparation of plans and with close attention to the details of the operation, a battle practice could be arranged and conducted which would afford the training necessary for the development of the battle efficiency of the entire command. Suitable provision should be made for the identification and observation of the fire of the various participating batteries, and for maintaining complete records of all data used by each in the practice, together with a diary of messages and orders received and transmitted and the exact time thereof. These combined records would constitute the basis for a thorough analysis of the entire battle practice, and this analysis could be made the subject for a conference or critique, participated in by all officers as soon as practicable after the close of the practice. A later study of the details of this battle practice and the records thereof would afford the opportunity for devising means to overcome the demonstrated defects and deficiencies of the general defense plan. This study could be made under the supervision of the coast artillery district commander, at any convenient time and place after the close of the mobilization period and the return of the personnel to their proper stations.

A system of coordinated training along the lines proposed in this paper is believed to be practicable, for the personnel necessary

to constitute the battle team are now available, and only await coordination to bring them together. The ammunition required for the proposed training is not in excess of the total quantity now supplied to the separate organizations, and the transportation and all other necessary facilities are now on hand and require only judicious and economical distribution and utilization.

It is believed that some system along the general lines indicated above would soon succeed in developing the entire coast artillery personnel (Regular Army, National Guard and Organized Reserves) that are located in each corps area, into a highly efficient battle team ready and available for immediate service in case of emergency at any of the harbor commands within the given corps area.

It is the duty of every man and woman to study deeply this question of national security, and learn how the process by which it is to be achieved results in a stronger and more reliable body of men and women. The future depends upon the development of every phase of individual character, and every element of national safety. There is but one voice that can determine the course to be pursued; one voice that can decide whether we shall follow the counsel of the fathers and the lessons of our own experience; one voice that can give direction to wise policies; and that is the voice of the people.—*General John J. Pershing.*

Antiaircraft Defense

By MAJOR J. C. HAW, C. A. C.

EDITOR'S NOTE: *This sketch is a highly condensed and entirely non-technical presentation of antiaircraft problems, materiel, organization, tactics, and accomplishments. While it is hoped that such a sketch will be of some interest to officers who cannot keep in close touch with this work, the chief object in compiling it has been to provide material for those who are called upon to present the subject in brief and simple form to R. O. T. C. students, civilians, and others who are more or less unacquainted with this phase of the Coast Artillery Corps' activities.*

THE term "Antiaircraft Defense" comprehends all defensive measures against aerial attack. It is evident that aviation itself is infinitely the most efficient and important single component of this defense, for our pursuit planes can seek out the enemy and attack him in his own element—the air—on equal terms. However, the work of the Air Service must be supplemented by purely ground formations. In the Civil War, the Cavalry of both sides made frequent raids in the enemy's rear; in the World War, with the German Navy completely bottled up, we saw his submarines in constant operation, while on the surface raider after raider went to sea and terrorized the Allied Merchant Marine. As on land and sea, so in the air; no matter how numerous our planes or how efficient our aviators, it is impossible to prevent a bold enemy from carrying out successful expeditions over our territory. The delay in gathering a sufficient concentration to meet air attacks in force may enable the enemy to reach his objective.

Further, the airplane is an offensive weapon, whose mission it is to seek out and destroy the enemy in his territory. If the strength of the Air Service is frittered away by scattering a great proportion of its units here and there for defense, we give up all hope of taking the initiative in the air. However, it is necessary to assign a relatively small number of pursuit planes to defensive work. These craft conduct constant patrols, and they fight in the same manner as other pursuit aviation.

To defend troops, small isolated positions of importance and large cities, ground defense elements are necessary. Only small areas should be forced to depend entirely on such elements, and for all large areas, pursuit aviation and ground defense should be combined.

The protective components are divided into two classes—active and passive. The passive elements are: kites and barrage balloons, camouflage, searchlights, and the information service.

Large kites may carry metallic cables. Barrage balloons are small affairs especially designed for forming a barrier of balloons. In the defense of London, nets were used, three adjacent balloons being joined by wire cable from which hung wires 350 yards long, with a sandbag at the end of each. The balloons were about five hundred yards apart. Perhaps a more efficient method is to place the balloons closer together and rely solely upon the retaining cables. If two balloons are used together, one above the other, an altitude of 11,500 feet may be attained. As an aviator cannot see the wires, he will not attempt to fly through the balloon barrage, but must alter his course to right or left or climb above it. The effect is to diminish the accuracy of bombing. Balloon barrages are useful for small areas only.

Camouflage is now tremendously important. At the front, every position must be concealed from enemy aviators. Otherwise it is subject to accurate artillery fire as well as bombing and aerial machine gun attack; while the enemy's general plans of action are much more likely to be successful if he has full knowledge of our dispositions.

In other cases, positions to be camouflaged are of two classes; namely, landmarks and objectives. The aviator can fly by compass; but on long journeys he is liable to need a reference point here and there to keep an accurate course, and in all cases he must have a distinguishing landmark at the point to be bombed.

Smoke may be used to camouflage small areas. If several patches of smoke be generated simultaneously, the flyer does not know which one hides the point he wishes to see.

Flimsy scenery may be erected, in exact imitation of structures located elsewhere.

Suppression of light is a most obvious measure of defense. Even at night, a large city cannot be hidden; but if no lights are visible, then the aviator cannot see it until he is almost upon it and must depend upon compass and landmarks to reach it. When Paris was fully illuminated, aviators at Villers-Cotteret could distinguish the glow, although the distance was approximately seventy-five kilometers. The lights in railway yards are very conspicuous from overhead, unless carefully shielded, while the glare from the opened door of a locomotive firebox is the aviator's best indication of a railway line. In Paris, patrols were constantly alert to enforce darkness, and necessary lights were made blue.

Sometimes "luminous camouflage" is used. High power lights with reflectors are scattered about over the area containing the point to be hidden, which is rendered invisible by the upward glare. This is obviously a very expensive measure.

Also lights may be dispopsed at some suitable point in a conformation that copies exactly some village or area with which the enemy is familiar, so that he is deceived as to his true position.

The British did a bit of camouflage that was almost a classic. To quote the report of an American officer on this British dump which was located near the front:

> Along the best line of approach, and at the usual distance from the area actually to be defended, were placed three batteries of artillery and three triangulated lights. These guns and lights were poorly camouflaged, so that when a high flying plane came over to photograph the dump they would show in the pictures, and at the same time it would appear that the British did not want them to show. Thus the enemy knew the relation of these guns and lights to the location of the dump. However, about a mile in advance, along the same line of approach, was the exact duplicate of the same layout with the exception that this installation was perfectly camouflaged. The result was that when an enemy plane came over at night and these latter batteries and lights opened on him, he knew from study of the photo that very soon he must drop his bombs to hit the dump. This he always did and the bombs therefore hit in advance of the dump. Then before daylight the British would go out and fill in the bomb holes and dig holes with the same relation to the inner defense that the actual bomb holes had to the outer defense. It was in January, 1918, that I saw this defense and it had operated successfully through the entire war until that date without the ruse being discovered.

Searchlights are used to discover the enemy at night and keep him in view of our guns or planes. They must be portable so that they can be placed wherever necessary.

The standard type in our Army is the Cadillac unit. When the light is in operation, the engine of the truck operates a generator mounted on the truck, which in turn furnishes power to the light. The light itself is of the open, or dishpan, type, sixty inches in diameter. It is mounted on a very light carriage with Ford wheels, pushed by hand; a cable six hundred feet long is provided for conveying the current from generator to light. When a move is to be made the light is run up on the track, which thus carries the entire unit. There is also a 30-inch light that can be placed in trees, towers and similar points of vantage.

In addition to revealing the plane to our own forces, searchlights are very confusing to the enemy pilot, for when the beam is upon him he can see nothing of the ground or of other aircraft.

Evidently, it would be almost impossible for a searchlight to discover a plane by searching at random, so listening apparatus is

provided to determine the direction of a plane by the sound of its engine. The problem of following the exact course of a target by sound is no easy one, for by the time the noise reaches the listener, the direction from which it appears to come is no longer the true direction to the target. One reason for this is that the plane moves some distance while the sound wave is travelling to the listener; wind and other factors add to the difficulties encountered.

The underlying principle of practially all listening apparatus is the detection of difference in phase of sound waves, the same principle that enables men and animals to determine the direction of a sound. Sometimes there are two receivers mounted on opposite ends of a rod that turns about a pivot; tubes lead from each receiver to the listener's ears. There are also single receiver types of parabolical or spherical shape. In either case, the receivér collects and concentrates the sound; and the direction is read off from an oriented "azimuth scale" (somewhat similar to the horizontal limb of a transit). This direction is then set off on a similar scale on the searchlight, and the target quickly located. Other types of apparatus are more complicated but subject to various defects. The most accurate device is said to be the Perrin Telesitemeter, with a mean error of only 0.13 of a degree.

Now for the active elements of the antiaircraft defense. The most important—pursuit aviation—has been mentioned already. Machine guns and antiaircraft artillery complete the list.

Antiaircraft machine guns are used to prevent low-flying planes from bombing and machine-gunning our positions. They are employed in the defense of roads, trenches, strong points, artillery emplacements, antiaircraft guns and searchlights, and so on. The most promising machine gun for antiaircraft purposes seems to be the water-cooled Browning .50-caliber, firing tracer or explosive bullets at the rate of 500 aimed shots per minute. Its horizontal range is five miles; vertical range, 8,000 to 12,000 feet.

There has just been developed another machine gun of 1.4 inches caliber, firing explosive shell at the rate of 100 to 120 shots per minute, with a vertical range of 14,000 feet. These shells burst on impact with the lightest fabric.

As the targets fly low and at great speed, appear unexpectedly, and are visible for very short periods of time, elaborate sighting is impossible, and the only feasible way to get hits seems to be by using tracer bullets so that their trajectory is visible.

A more complicated matter is that of antiarcraft artillery. This class of fire involves the greatest problems that have yet confronted the ballistician, the ordnance designer, and the artillery-

man. The target, whose vulnerable parts often occupy less than two cubic yards, moves at a speed of 80 to 200 miles per hour in three dimensions, and can change speed and direction with startling rapidity. If the plane should travel at 180 miles per hour and it should take the projectile 20 seconds to reach it, the gun would have to be pointed *one mile* ahead of the target even if our methods were absolutely perfect.

It is necessary to use high explosive shell or shrapnel, as these burst in the air, endangering everything within a radius of approximately fifteen yards. Their use entails fuse complications (mentioned later) but these are outweighed by the gain in danger space.

The latest American gun (still in the experimental stage) is 4.7 inches in caliber, with a muzzle velocity of 2600 feet per second, firing a 45-pound projectile to a vertical range of almost seven miles. With all-round fire, elevation from minus 5° to plus 80°, automatic breech opener, and pneumatic loading device, it is easily aimed and can be fired very rapidly indeed. A 3-inch gun of similar model is also being tried out. These guns are either self-propelled or towed by trucks or tractors, make fast time on good roads, and can travel across country.

The chief ammunition difficulty has been in the fuse question. In order to make the projectile burst at the exact instant desired, a very accurate time fuse is a necessity. The extreme changes of air pressure in antiaircraft fire render powder-train fuses unreliable. One alternative is clockwork. Imagine accurate clockwork that can withstand the shock of discharge and the tremendous velocity of rotation of the projectile! Such a fuse has been developed, however, and gives promise of considerable accuracy. A fuse actuated by the rotation of the projectile has also been proposed.

Several improved fuse setters have appeared of late, whose object is to set the fuse on the very latest data, including an allowance or lead for the time used up in setting the fuse, loading, and firing. These setters work automatically, eliminating the errors caused by waiting for an operator to receive data and set it on the fuse-setter. Some of them work by electricity.

However, the most intricate and perplexing difficulties are encountered in the realm of fire control—that is, the determination of the data to be set upon the guns in order to hit the target.

All fire at moving targets is a matter of prediction. The exact positions of the target at two or more given instants are determined; upon this information it is predicted that the target will

arrive at a certain point at a certain instant in the future, and the shot is fired at this imaginary point. The shorter the time occupied by the personnel in getting this data and firing and by the projectile in reaching its destination, the closer the predicted point to the last known point, and hence the greater chance that the target will actually reach the predicted point at the expected instant, instead of changing direction, altitude, or speed. The time element becomes of incalculable importance when the target travels from one and one-third to three and one-third miles per minute.

To determine the position of a target at any instant, it is necessary to know: (1) its direction from the battery, (2) its range (straight line from battery to target), (3) its altitude. In our service, these data are generally determined by using instruments at both ends of a measured base line. Obviously, it would be more satisfactory to eliminate one station and make all the measurements from a single point near the guns. There are several instruments for doing this, and when they are sufficiently developed, a single station scheme will undoubtedly replace the present system.

The next step is the prediction of the future position of the target; and finally, this data must be translated into terms of elevation, direction (or sight setting) and fuse setting for the gunners. (The gun may be aimed by the use of a telescopic sight or laid by an oriented scale and a quadrant, in which case no sight is used.) All these very involved processes must be performed in a few seconds —the fewer the better. Hence a great advantage will be secured if a single machine can be made to perform these computations, which must be done almost instantaneously and as a continuous operation, so that there is a constant flow of data to keep up with the movements of the target. Several such machines have been invented. Some of them are purely mechanical, others depend upon the use of electricity, but none have given full satisfaction. The ultimate aim is a single machine, operated by one man, that will measure the position of the target, predict its future position, and compute the firing data to set on the guns. Such a development will increase tremendously the accuracy of fire.

The next consideration is the organization of antiaircraft units. In our Army, the basic group is the regiment, which consists of one artillery battalion and one machine-gun battalion. The artillery battalion is composed of three gun batteries of four guns each (total, 12 cannon) and one searchlight battery of twelve lights. The antiaircraft machine-gun battalion consists of four companies of twelve machine guns apiece, a total of forty-eight machine guns. There are 63 officers, 1 warrant officer and 1,450

men in an Antiaircraft Regiment. To each Army Corps (about 83,850 men) is assigned one regiment of antiaircraft artillery. To each Army (composed of two or more Corps) is assigned one brigade of three regiments of antiaircraft artillery, in addition to the regiment with each Corps.

Before considering the manner in which antiaircraft elements are disposed for defense, it is necessary to understand the mission of the defense. This may be stated as follows:

(a) To prevent enemy aircraft flying at such heights over our positions that they can observe and photograph, direct artillery fire, attack our balloons, drop bombs with accuracy or attack troops with machine guns.

(b) To prevent enemy aircraft dropping bombs on vital points behind our lines.

(c) To compel enemy aircraft flying in formation to lose their formation and thus render them more vulnerable to attack by our own aeroplanes.

Then we should know the kind of aircraft that we will be called upon to oppose. This information is contained in the following table:

Kind of Plane	*Approximate Altitude—feet*	*Speed—Miles Per Hour*	*Remarks*
Pursuit	Very High	100—200	Purely fighters.
Reconnaissance	16,000	80—120	Photographic and general observation.
Day bombers	16,000	80—100	Bombing close to their own base.
Night bombers	7,500	80—100	Long distance bombing.
Infantry or attack	200—3,000		Machine-gun attack of ground forces.
Dirigibles	Very High		Long distance bombing, usually by night.

There are two cases of defense to be considered; namely, front lines and back areas.

Front-line defense is based on the antiaircarft regiment. First, there is the gun area. About 1,200 to 2,000 yards in rear of our front lines are placed two rows of antiaircraft machine guns, followed by two lines of antiaircraft artillery from 2,000 to 5,000 yards in rear of the infantry's first line, each battery being accompanied by one searchlight. In rear of the gun area comes the airplane area, extending about 25,000 yards to the rear of the first line,

provided with antiaircraft searchlights and patrolled and defended by our pursuit planes. Still further to the rear each Army is charged with the defense of all railheads, depots, parks, dumps and headquarters in its own area.

The civilian is naturally more interested in the defense of rear areas, such as large cities. For such places, antiaircraft artillery is disposed along probable lines of approach, and also in one or more complete rings around the area. The outer ring may be 25,000

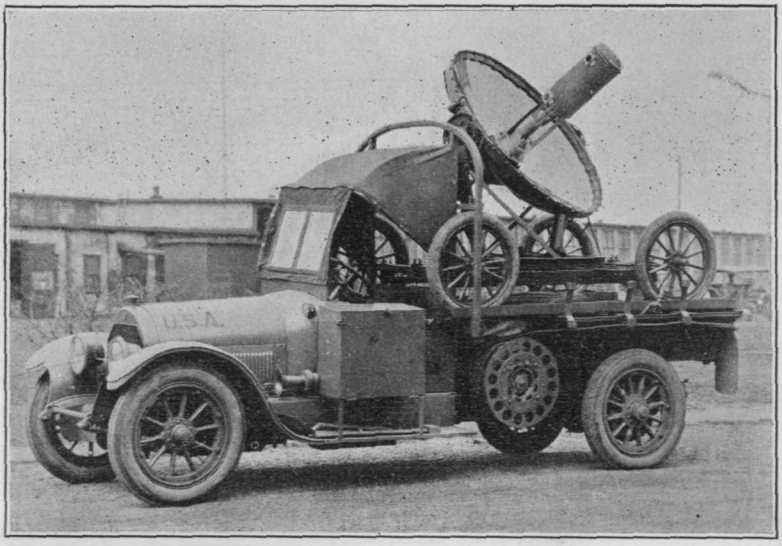

FIG. 1. CADILLAC SEARCHLIGHT UNIT

yards from a great city, while other batteries may be disposed within the city itself. Antiaircraft machine guns are placed at bridges, important factories, etc. Searchlights and listening posts play an important part. Smoke screens and painted scenery may be used. Pursuit squadrons are located at suitable places.

All of these elements are linked up by an intricate network of wireless, telegraph, and telephone communications, which also connect with observation and listening posts placed at intervals all the way to the theater of operations. In future, this system may be supplemented by radio from our own planes. Thus, when an enemy plane crosses our lines, the headquarters in rear are kept informed of its progress. At the antiaircraft defense headquarters in Paris, for example, everything centered in the office of a general whose sole task was the command of the antiaircraft defense. A great map showed the location of every battery and airdrome, and on this was traced the course of the invading planes. A light flashed

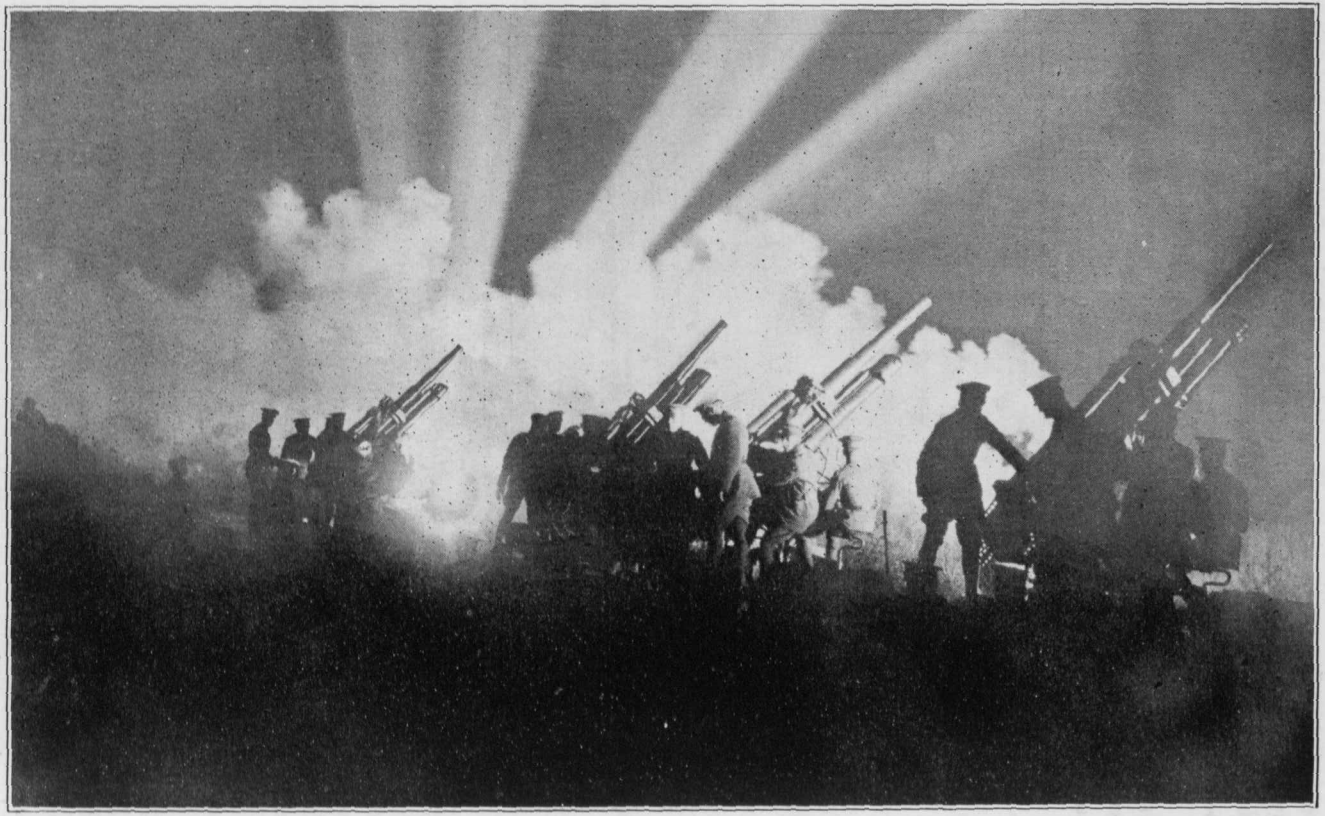

FIG. 2. ANTIAIRCRAFT GUNS IN ACTION

on for each unit as it went into action. Often the attack was defeated at such a distance from the city that it was not necessary to sound the alarms which sent citizens scurrying into cellars and subways.

So much for organization and tactics. As the difficulties of antiaircraft artillery and machine-gun fire have been emphasized, let us pause for a moment to examine into the actual accomplishments of these two elements. Since the vulnerable part of an airplane consists of less than two cubic yards, relatively few direct hits can be expected. However, antiaircraft fire, if uncomfortably close to the pilot, forces him to change his course or to fly considerably higher, and he is unable to photograph, observe, bomb or machine-gun ground formations with full efficiency. Moreover, if he changes course or altitude, he is liable to become separated from the other planes in his unit, and is then easy prey for our pursuit planes.

Many pursuit pilots forget that their own experience forms no fair criterion, as the pursuit plane is the hardest to hit and moreover can do the least damage to anything on the ground; while the primary mission of antiaircraft artillery and machine guns is to protect *ground* formations.

Our battalions in France made a splendid record, shooting down fifty-nine planes; forty-one of these were shot down by two antiaircraft machine-gun battalions (total ninety-six guns) at an expenditure of 5,491 shots per plane brought down. The value of special training is shown by the fact that during the same period there were about 1,500 other guns of the same type along the front; these, not being manned by specially trained personnel, brought down only two planes, as far as known. Our antiaircraft artillery brought down eighteen planes at an expenditure of 1,050 shots per plane.*

It is encouraging to compare these figures with the statistics of deaths (not wounds) caused by artillery and rifle fire in terrestial combat. In the World War, it took 395 Allied shells to kill one German. In the Franco-Prussian War, it required 1,100 bullets to kill a man.

But the wartime records of antiaircraft fire have since been surpassed in the most astounding manner. In firings at Fort Monroe, where the target was a sleeve 20 feet long and tapering from 4 feet to 2½ feet in diameter, towed by an aeroplane, the antiaircraft machine gunners last year made seventeen hits in 9,000 shots, or one hit for every 530 shots. On a similar target, 6 feet shorter, the artillery made two hits out of 118 shots, or one hit for

*These statistics were furnished the author by the COAST ARTILLERY JOURNAL, and were compiled from the records of the Chief of the Antiaircraft Service of the A. E. F.

every 59 shots. Of course, the conditions were more favorable than would be the case in war; but even so, the record is truly remarkable. Great things may be expected when an improved fire control system is developed.

At the same post, searchlights, working on information provided by a paraboloid listening apparatus, were able to pick up Navy Planes and Army Martin bombers in less than twenty seconds after the lights began searching.

Finally, to show the efficiency of a well-rounded defensive system in actual war, we may cite the statistics covering all night bombing raids on Paris in the year 1918. In this year, no less than 483 German planes attacked the French capital; thirteen of these were shot down, and *only thirty-seven* flew above the city itself, dropping a total of only 11,680 kilograms of bombs. Yet the Germans announced that 22,000 kilograms fell on Paris in a single raid, the night of September 15-16.*

From the moment that he crossed his own lines, a German pilot was harassed by searchlights, aircraft and artillery fire, until, discouraged, he dropped out of his formation, released his bombs on the nearest village, and sped for home.

If the Coast Artillery Corps, operating antiaircraft artillery, listening apparatus, searchlights, machine guns, and the information service, and assisted by the Air Service in patrol and pursuit work, can give as good protection to American cities as the French gave to Paris, we shall have reason to be proud; and if Congress will only give the Army men and money in sufficient quantities, we can do it.

L'Illustration, March 22, 1919.

For nowhere in our history can anybody find, for I have looked, a soldier, professional or National Guard, who took any part whatever in agitating for a war.—*Newton D. Baker.*

The Influence of Air Power on Coast Defense

By MAJOR J. T. MCNARNEY, A. S.

EDITOR'S NOTE: *Many* JOURNAL *readers will consider that in the following interesting article the author attributes exaggerated powers to airplanes and aerial components. They may also feel that some of his statements are not yet proven, or are at least disputable. However, the* JOURNAL *presents the article as representing the ideas of at least one member of the Air Service and will welcome further discussion of the subject.*

THE full development of air power cannot as yet be foreseen, but, considering it only in its present state of development, it may be stated that air power will exert a considerable influence upon both the strategy and tactics involved in naval, military, or combined operations. Specifically, it may be stated that the Air Service, as now organized, constitutes an important element in the positive system of coast defense, due not only to its ability to obtain and transmit information of the enemy but also to its ability to engage by fire action the hostile aerial, naval, and military forces.

The aerial forces available for operations in the event of hostilities may be classified as:

(1) The Observation Service, including both heavier- and lighter-than-air units.

(2) Combat Aviation, including pursuit, bombardment and attack units.

OBSERVATION

The role of the Observation Service in any type of operation may be briefly stated as follows:

(1) To furnish information as to the location, size, composition, disposition, and activity of the hostile forces;

(2) To increase the value of artillery fire by accurate observation for fire control.

Experience in the World War has amply demonstrated that single airplanes, manned by determined personnel, can execute reconnaissance missions even in the face of hostile superiority in the air and of heavy antiaircraft concentrations. The preliminary practice incident to, and the actual operations involved in the destruction of, the German War vessels placed off the Virginia Capes in positions unknown to the aerial forces participating, and well beyond the sight

of land, have proven the ability of aircraft, operating at long distances from shore, accurately to locate and report upon the size, nature, and activity of shipping operating off the coast. Joint Air Service and Coast Artillery exercises particularly at Fort Monroe and the defenses of Manila have demonstrated the possibility of conducting accurate fire at long ranges by the use of aerial observation. It may be stated, therefore, that any force possessing aerial observation has at hand a means by which accurate information of the enemy's strength, location and disposition may be rapidly obtained at will. Under favorable conditions it will also have available a means of determining enemy activities over an extended period of time and of obtaining observation for fire control on objectives which for any reason cannot be seen by ground observers. However, whenever the nature of the information desired is such that the observer must remain in observation for any considerable period of time, the success of the mission depends to a large extent upon the enemy reaction, which is in turn almost wholly dependent upon the relative activity of the opposing pursuit forces.

Bombardment

Bombardment is that branch of the Air Force whose primary function is to destroy hostile military or naval objectives by means of projectiles dropped from aircraft.

By a series of notable achievements, including several transcontinental flights, the Alaskan Flight, the World Flight, and the recent night flight of a squadron of bombardment airplanes from Langley Field to New York, the Army Air Service has amply demonstrated the ability of the present day airplane to cover long distances and arrive at the objective under unfavorable conditions of weather and visibility, both by day and by night. Further, the ability of bombardment aircraft actually to deliver attacks against objectives covered by extensive protective agencies, such as listening posts, searchlight installations, balloon barrages, and antiaircraft artillery, has been demonstrated by the successful German attacks on Paris and London, by the British day raids on Cologne and other Rhine cities, and by the flight of Italian aviators over Vienna. The numerous experiments carried out by army and navy aircraft against naval vessels have proven that naval or commercial vessels, regardless of type, can remain within the radius of action of aerial bombardment only at the risk of complete loss or serious damage. The damage inflicted by aerial bombardment during the World War cannot be taken as a criterion as to what may be expected at present, due to the fact that the great majority of bombs used on war raids

did not exceed fifty-two pounds in weight and seldom exceeded one hundred pounds. At present, with bombs ranging from twenty-five pounds to four thousand pounds, it is difficult to imagine any exposed objective which can successfully withstand aerial bombardment. The accuracy of bombing to be expected against any type of target cannot be arbitrarily set forth, depending as it does upon training, morale, enemy air and ground reaction, weather and visibility. However, with the recent and continual improvement in methods of bomb release, in bomb sights and in mechanical aids to flying, it is only reasonable to expect a continual and apparent increase in accuracy over that already demonstrated. Considering the above, it may be stated that a force having bombardment aircraft available and with operating bases within from 250 to 300 miles of the proposed objective will possess a means to inflict serious damage upon any exposed physical establishment either by night or by day. Day raids, however, will be influenced to a considerable extent by the hostile pursuit activity.

Attack

Attack is that branch of the Air Force whose primary function is to attack military objectives on the ground by means of light bombs and machine-gun fire.

Actual experience in the use of attack under war conditions is limited to the exceptional use of observation and pursuit units for this purpose during the latter part of 1918 and to the British operations in Mesopotamia. It can, however, be stated in the light of actual experience and the results obtained therefrom, that low flying airplanes carrying light bombs and machine guns have demonstrated their ability to silence or interfere seriously with the operation of hostile machine guns and artillery, to delay seriously the movement of formed bodies of troops or trains, to inflict casualties upon and reduce morale of troops in bivouac or cantonment, and to inflict serious damage upon aircraft on the airdrome, both by attacking operating personnel and by actual destruction accomplished.

It is apparent, therefore, that a force having aerial attack available (or when unavailable if existing conditions permit the use of observation or pursuit units for this purpose) will possess a means to delay materially the movements of, and to inflict casualties upon, supports and reserves, to delay the movement of supplies, to support any type of attack by counter-battery work against machine-gun and artillery emplacements, and indirectly to hinder enemy aerial operations.

Pursuit

Pursuit is that branch of the Air Force whose primary function is to seek out and destroy hostile aircraft, thereby gaining and maintaining control of the air.

Control of the air in its broadest sense is obtained only when all types of friendly aircraft are able to function without interference by hostile aerial action, and when, at the same time, the enemy aerial forces are prevented from attaining their several objectives. Complete control of the air is seldom attainable. However, control of the air in a more limited sense, or in other words superiority in the air, may be said to exist when the friendly aircraft are enabled to complete successfully a greater proportion of their missions than the enemy. Control of the air depends in a large measure upon the operation of pursuit aircraft. With the opposing forces approximately equal the force possessing the initiative may, by concentration of all or a large part of the pursuit forces available, secure superiority in the air in a particular locality for a limited period of time. Such superiority is possible even to a considerably inferior force, but only at the cost of hostile control of the air upon the expiration of the period of patrol. If, however, operations are continued over a considerable period of time, the force possessing superior numbers or more adequate replacements will eventually secure and maintain superiority by aerial combat. In addition to aerial combat, superiority may be attained by direct action with bombardment and attack against the hostile airdromes or carriers; but as long as any hostile pursuit capable of taking the air exists in the zone of activity the maintenance of superiority or control of the air rests with the pursuit. The value of pursuit in any operation may then be said to vary according to the measure in which it permits the operation of friendly forces, both ground and aerial, without interference from hostile air activities. It may be stated, then, that a commander having available a pursuit force approximately equal to that of the enemy may obtain for a limited period of time superiority in the air at any point desired, such superiority conferring comparative freedom of action upon his remaining aerial, naval and military forces.

The foregoing discussion having brought out in brief what may reasonably be expected of the several branches of an aerial force in any type of action, it is now proposed to set forth as concisely as possible the influence exerted by aerial participation in attacks against a coast line and the role of the aerial forces in the defense thereof.

The form or forms of attack adopted by a force operating against a coast are, of course, dependent upon the existing situation, the enemy forces to be overcome, the forces available, and the mission assigned. Of the several general forms of attack possible, the following,—namely, raids, direct attacks against harbor fortifications, and landing attacks in force, have been selected for discussion due to the paramount interest of the military forces therein. The support furnished any overseas operation by aerial participation therein must be measured by the ability of the invading air force to accomplish successfully the specific missions assigned. The actual missions assigned will depend upon the ultimate mission of the entire force, the number and type of aerial units available, and the existing or obtainable knowledge of the nature and location of the defenses to be overcome on land, on water, and in the air. The successful execution of such missions is dependent not only upon the nature and extent of the hostile aerial and ground reaction but also upon the ability to launch the required number of aircraft from floating bases or to obtain land bases protected from ground interference by military support or concealment. Such limitations constitute a severe handicap to successful operation, but, under ordinary weather conditions and especially if unopposed by a well-organized and balanced air force, they cannot be expected to prevent operations.

Raids

In general, raids may be classified as:

(1) Unsupported,

(2) Supported.

Raids of the first class are surprise attacks carried out by light enemy forces for the accomplishment of a minor mission. Supported raids are those in which the forces actually participating in the attack are escorted or assisted by considerable naval or aerial forces or by both in the attempt to carry out an important mission which will affect the entire campaign. Either class of raid may be effected by aircraft, surface vessel, or submarines either alone or in combination.

Unsupported raids, however, will rarely be undertaken by bombardment aircraft unless secure bases are available within their effective radius of endurance, as otherwise they must operate from carriers or tenders which are extremely vulnerable to attack by aircraft, destroyers or submarines and therefore require support. This type of raid, in general, will be restricted to light fast surface vessels or submarines which will depend for safety upon the avoidance of naval combat by speed or concealment. A consideration of the

influence of aerial operations on this type of attack may then be restricted to that caused by aerial observation. In accordance with the possibilities of aerial observation as previously outlined, and due to the fact that unsupported raids will in general be carried out against unprotected or poorly protected localities where little or no aerial opposition is to be expected, the commander of the raiding force will be enabled to obtain:

(1) Accurate information of the objective to be attacked, including the strength and location of existing fortifications, supporting naval forces if any, and the nature and location of shipping, harbor or other utilities which it is desired to destroy;

(2) Accurate information as to the enemy naval or aerial forces which might interrupt the mission or be concentrated against him;

(3) Accurate information as to the relative location of commercial shipping and its naval support if any;

(4) Observation of artillery fire at long ranges or while protected from view by a smoke screen or other obstruction.

The participation of aerial observation in unsupported raids may then be expected to result in:

(1) Increased knowledge as to the exact nature and location of the objective to be attacked, with a consequent increase in the effectiveness of the raid and in the damage inflicted;

(2) Increased knowledge of the strength and location of defenses to be overcome or avoided, with a consequent decrease in the possibility of resulting loss;

(3) And therefore a likely increase in the number of such raids against both commercial shipping and land objectives, especially when superiority on the sea is yet to be obtained.

Supported raids may be accomplished by aircraft, surface vessels or submarines, either singly or in combination. The aerial forces participating in such raids will usually consist of observation and bombardment units and may, in addition, include pursuit and attack units.

As far as the operation and resulting influence of observation is concerned it will differ little from that previously outlined in connection with unsupported raids and therefore requires no further discussion.

Prior to the advent of aerial bombardment, it was usually necessary, even when enjoying command of the sea, for an enemy force, contemplating a raid of any magnitude, to support his attacking vessels by superior squadrons of battleships. This resulted in the exposure of his capital vessels to loss from defending land arma-

ments, destroyers, submarines, and mines. Such raids would then be undertaken only after a serious consideration of the probable results to be obtained. However, with the advent of aerial bombardment the hostile commander will have available an arm of great destructive power which is capable of operating over long distances, thereby reducing to a considerable extent the liability of loss or serious damage to the supporting vessels.

Considering, then, the capabilities of bombardment aircraft as previously discussed, it may be stated that a force possessing aerial bombardment, in addition to surface and underwater craft, will have available a means to accomplish the following, all without undue risk to the armored battleship:

(1) The destruction of harbor utilities, naval bases, commercial shipping, and industrial plants of military value;

(2) The destruction of naval vessels protected by land armaments, refitting at naval bases or operating on the high seas;

(3) The obstruction of naval communications;

(4) By systematic and continued raids on harbor fortifications, such damage to the defenses, with the consequent reduction in the morale of the defenders, that penetration into, or complete reduction of, the harbor defenses by a direct naval attack is rendered feasible;

(5) The concealment of the true mission by feints at a considerable distance;

(6) The destruction of or rendering untenable airdromes occupied by defending aerial forces.

Raids by aerial bombardment may require the support of aerial forces unless executed under cover of darkness or against localities where the defenses against aircraft are non-existent. In a similar manner, raids undertaken by naval vessels may require protection against attack by hostile aircraft. Such support may and, in the case of raids which will influence the existing situation to any considerable extent, probably will consist of:

(1) Pursuit operations to maintain superiority in the air during the continuance of the raid, thereby preventing aerial attack on the raiding forces either by gunfire or by bombs;

(2) Attack operations against personnel to interfere with the operations of machine guns and artillery weapons;

(3) Attacks against hostile airdromes with light bombs and gun fire to prevent operation therefrom during the continuance of the raid.

In view of the foregoing, it may be stated that aerial participation in supported raids will in general result in:

(1) Increased knowledge of the objective to be attacked and the defenses to be overcome or avoided, thereby increasing the probability of success;

(2) Increased possibilities of inflicting serious damage upon the opposing naval forces regardless of their location, thereby directly aiding in the attaining and maintaining of control of the sea;

(3) Increased possibilities of inflicting serious damage upon military objectives, thereby directly influencing the action of the combined force especially in attacks against heavily fortified positions;

(4) Decreased possibility of damage of the attacking units by naval, military or aerial forces, thereby increasing the probability of success;

(5) Decreased possibility of damage to the supporting naval forces by naval or aerial operations;

(6) Rendering possible the execution of successful raids, either by day or by night, without counting too heavily upon the element of surprise;

(7) Requiring the defenders to maintain defenses along the entire coast line, thus dissipating their forces;

(8) A probable increase in the number of, and in the damage resulting from, attacks of this type.

Direct Attacks Against Harbor Fortifications

History is replete with instances demonstrating the difficulties, well nigh insurmountable, confronting a naval force attempting to penetrate within a well-defended harbor, either with or without the support of land forces. Such attacks, demanding the participation of capital ships, the loss of which may result in the failure to maintain sea communications thereby causing the failure of the entire campaign, are undertaken with caution and only where warranted by corresponding results. However, conditions may arise when, due to superior armament or new offensive means or methods, such attacks may be justified. Whether the contemplated attack is to be carried home by naval forces alone or by both land and naval forces, preliminary operations are necessary in order to enable the capital vessel to approach within range of the defending armament and to deliver the maximum effective fire against such armament with the greatest degree of safety to itself. Such operations must include a preliminary reconnaissance of the position to be attacked, followed by the removal of barriers to the approach, and finally the execution of such measures as may be possible to reduce the defensive power of the position in preparation for the final assault.

There can be little doubt but that in any operations undertaken by a modern power against a heavily fortified position, aerial operations of some nature may be expected throughout all phases of the attack. Further, it is altogether likely that such preliminary reconnaissance as may be necessary, as well as reconnaissance during the course of the combat, will be accomplished almost in its entirety by aerial observation. Considering then the possibilities inherent in that branch, it is only reasonable to assume that the attacking force will be able to obtain accurate and timely information as to:

(1) The composition, location, and strength of all emplaced armaments for harbor defense, as well as such naval elements as may be present, and the organization for landward defense;

(2) Fire control and searchlight installations, channels and channel markings, and the location and extent of mine fields;

(3) Location, strength and activities of supporting naval forces within striking distance;

(4) Location and type of airdromes occupied by supporting aerial forces;

(5) Location of bays, inlets or landing fields without organization for defense, which may be occupied for the purpose of dispatching bombardment aircraft;

(6) The nature and extent of damage inflicted upon the harbor defenses, utilities, naval or aerial supports during the preliminary operations prior to the assault.

Having determined by a preliminary reconnaissance the obstacles to be overcome, it is only to be expected that all means available to the attacking force will now be employed in order to reduce the effectiveness of the defenses, both prior to and during the assault. The presence of aerial bombardment makes available an arm capable of attaining such results without the necessity of unduly exposing the capital ships to loss or damage. The participation of aerial bombardment throughout the attack then is to be expected. This participation will be in the nature of supported raids as previously discussed. These raids will be directed against such objectives as are most dangerous to the execution of the assigned mission, which will be in general those elements of the defense most dangerous to the capital vessel.

From the foregoing discussion, the immense advantage accruing to an attacking force possessing aerial observation and bombardment over one not so equipped can easily be seen. However, in order to obtain this advantage in its fullest measure, it is necessary to support these forces by aircraft capable of neutralizing enemy defensive measures, both ground and aerial, directed against either the units

actually engaged in the attack or against the supporting units. It is in this role that pursuit and attack units fulfill their primary functions. In addition, these units may, if conditions warrant, participate in the attack against objectives not concerned in antiaircraft activities, such as personnel operating both primary and secondary armament, and supports and reserves attempting to prevent landing operations within the harbor or preparing to counter-attack the investing land forces. The influence of aerial operations on direct attacks against a heavily fortified position may then be summarized as follows:

(1) The commander of the attacking forces will be better able to make an accurate estimate of the situation both prior to and during the successive phases of the attack, thereby increasing the probability of success;

(2) Render possible the infliction of serious damage on coast defenses, exposed personnel, fire control installations and naval vessels on the high seas or protected by land armaments without endangering to any considerable extent the first line battleships;

(3) Produce a likely increase in the number of preliminary attacks and in the resulting damage upon the defenses;

(4) Render possible the placing of a well-directed fire of major caliber upon the defenders' position without undergoing the danger of directed fire in return;

(5) Decrease the probable damage to the fleet during the successive stages of the attack by direct action against the defending aircraft and airdromes;

(6) In general, to increase the probabilities of the success of this type of attack, thereby increasing the number of such attacks to be expected in the absence of an adequate aerial defensive organization, with the possibility that the deterring influence of harbor fortifications will be in a large measure dissipated.

Landing Attacks In Force

An army which is to maintain itself in an enemy country must, in addition to securing control of the sea, secure a harbor where existing or extemporized facilities will permit the unloading of artillery, transport, and other heavy war material. As such harbors will in general be heavily fortified, the invading forces will, unless such defenses have been reduced by a direct naval and aerial action, be restricted to beaches suitable for landing large forces and within striking distance of an available harbor. Attacks of this nature involve the debarkation of troops consisting largely of infantry, without

transportation and with little artillery, but supported by artillery fire of ships' guns and by combat aviation.

In this form of attack, as in any other, reconnaissance both prior to and during the action is certain, such reconnaissance being effected largely by means of aerial observation. The results to be expected therefrom may be stated as follows:

(1) Make available information concerning the nature and extent of beaches considered available due to their proximity to a military objective;

(2) Make available information of the defensive measures undertaken at such beaches, including intrenchments, wire entanglements, artillery and machine-gun locations, etc.;

(3) Give timely information as to the location and movement of beach supports and reserves;

(4) Make available information concerning road and railroad facilities and localities offering special opportunities for the delay of movement of personnel and supplies;

(5) Give timely information as to the location of supporting aerial forces;

(6) Give timely information as to the approach of naval units which might interrupt the operation;

(7) Increase the accuracy of naval fire in support of the attack by observation for fire control.

The successful issue of the operation depends in a large measure upon the ability of the invading forces to decrease by every means possible the time involved in landing a force sufficient to prevent dislodgement by such beach supports and reserves as may be concentrated by the defenders, until it is possible to land a sufficient force to assume the offensive. In accomplishing this object the invaders may be expected to:

(1) Take advantage of the element of surprise;

(2) Approach the beach selected as closely as possible before disembarking in small boats;

(3) Delay by every means possible the concentration of beach supports and reserves.

Further, due to vulnerability of the unarmored transports, the disadvantageous position and immobility of the troops being carried in small boats, and the difficulties involved in landing therefrom in the face of organized resistance, in order to insure success the attacking forces must:

(1) Insure the prevention of an effective attack on the transports either by aerial bombardment or artillery fire;

(2) Insure the prevention of an effective attack on the small boats by aerial attack units, by artillery or by machine-gun fire;

(3) Support the attack with an artillery preparation designed to destroy obstacles such as wire;

(4) By observed fire and aerial action destroy or prevent the operation of machine guns and both light and heavy artillery.

Consider then the possibilities inherent in the Air Force—pursuit, attack, and bombardment—to obtain these ends. Due to the ability of bombardment aircraft to cover long distances with great speed, it is possible to mislead the defenders as to the true intentions of the invaders by means of feints against other portions of the coast and still have the raiding forces available for participation in the main attack.

It is by use of the Air Force alone that the offensive may be carried to objectives beyond range of supporting naval artillery, and the early initiation of such measures may well become the determining factor in the success or failure of the engagement. Such offensive measures will include direct attacks against reserve cantonments and against supports, reserves or artillery on the march, measures to delay the arrival of such forces by destruction of bridges, blocking defiles, etc., and the attack of airdromes. The Air Force may in addition be called upon to render support at the scene of the actual engagement and, in this role, is capable of interfering seriously with the operation of machine guns and both light and heavy artillery, thereby not only affording support to the debarking troops but also rendering protection to the transports and naval vessels exposed to long-range artillery fire. Further, pursuit operations afford the only effective means to insure the results outlined above and to prevent attacks launched by aerial units against the small boats, transports, airplane carriers and tenders, or the supporting naval forces.

An analysis of the above possibilities of aerial participation in a landing attack will clearly show:

(1) That every essential required to insure success can be attained, or at least appreciably furthered, by such participation;

(2) That the probability of the success of such attacks is greatly increased;

(3) That the probability of serious losses to any element of the attacking forces is materially decreased;

(4) That the present system of positive coast defense will in general be unable to prevent landing operations by an invader provided with an efficient air force unless supported in turn by well-organized combat aviation.

In spite of the handicap imposed by the very nature of an overseas operation, it is evident that air power properly used constitutes an invaluable aid which may, and if unopposed will, in most cases furnish that superiority in offensive power necessary to insure success. It is imperative, therefore, that any system of coast defense include measures to counter this power effectively.

Due to the increased knowledge and offensive power available to overseas invaders through aerial operations, it is more than ever necessary for the defender to obtain accurate and timely information as to the location, size, composition, and activities of the invading forces in order that the necessary defensive measures may be undertaken without undue dispersion of forces or loss of time. This requirement can be met by the employment of aerial observation as follows.

A line of distant reconnaissance should be established which by means of rigid dirigibles and airplanes operating from naval scouts will insure determination of the location of the approaching enemy forces while still at great distance from the coast. In addition, observation squadrons should be stationed at strategic points along the coast, usually in proximity to harbor defenses. These units will initiate a system of coast patrol designed to furnish accurate and timely information of the approaching hostile forces. Opposite beaches feasible for enemy landings and opposite harbor defenses, such patrols, operating up to a hundred miles off shore, will be practically continuous. They will be in continuous communication by radio with shore stations and capable of communicating with vessels at sea. Such patrols, supplemented by captive balloon observation, will, under any weather conditions except long-continued fog, locate, maintain surveillance over, and make accurate report upon the location, size, composition, and direction of motion of the approaching forces. In addition these squadrons will furnish aircraft to cooperate directly with coast defense artillery. These aircraft will furnish shore batteries with the information necessary in order to open and maintain a well-directed and effective fire on enemy objectives when long range or intervening obstacles, such as smoke screens, make shore observation of fire impractical.

In general any type of attack against a coast may be met by any one or by a combination of the following methods:

(1) By offensive action preventing the hostile forces from approaching within striking distance of the coast;

(2) By destroying or rendering untenable the position of the forces actually engaged in the attack;

(3) By destroying or rendering untenable the position of the naval forces supporting the attack.

The first method will, in general, be undertaken by the fleet assisted by aerial forces and will not be discussed further. The second and third methods will be undertaken by the combined operation of naval, military and aerial forces. However, since the system of coast defense must be based upon the assumption that the battle fleet will not participate in coast defense as such, and that the defense must be complete even if control of the sea is lost, the participation of naval forces must not be relied upon. Of the remaining elements, the air force is the only one capable of maintaining an effective offensive or offensive-defensive against the invading forces, as follows:

(1) Against airplane carriers and their naval supports;

(2) Against transports, battleships and other craft prior to their advance to a position within range of shore batteries;

(3) Against enemy aircraft, once their attack has been initiated;

(4) Against enemy aircraft observing fire for naval artillery;

(5) Against transports and their supports at localities where, due to surprise or lack of facilities, long-range artillery is non-existent.

Further, it is of extreme value in the attack against troops debarking in small boats and in the disorganization and delay of troops already landed. The role of the Air Force in coast defense may then be summarized as follows: Pursuit, attack and bombardment groups should be concentrated at strategic centers for aggressive operations to—

(1) Destroy or inflict the maximum possible damage upon the hostile aerial and naval forces before they come within range of the existing artillery weapons;

(2) Render untenable any position taken up by hostile aerial and naval forces for the purpose of bombarding or making an attack in force against any shore objective,—this action being coordinated with such coast defense artillery as may be available at the point of attack;

(3) Destroy or render untenable the position of transports or small boats carrying landing parties,—this action being coordinated with such coast defense artillery as may be available at the point of attack;

(4) Cooperate with beach supports, reserves and the mobile forces in attacks against troops already landed;

(5) Destroy hostile aerial forces engaged in the attack of, or in support of, an attack against land defenses,—this action being coordinated with such antiaircraft artillery as may be available at the point of attack.

It may thus be seen that the Air Force, as well as the other branches and arms of the military and naval forces, has a distinctive mission, and, while in the present state of development it may not constitute a self-contained and positive system of coast defense, it is an arm essential to the defense of a coast line and must in a large measure be depended upon to counteract the influence of aerial participation in the attack.

We all hope and pray that it may not be necessary for our sons or for any future generations of Americans to defend by force of arms this nation's principles, ideals and rights. But who can say that our wish will come true or our prayers be answered? Who can say that history will not repeat itself—that the future will be unlike the past,—that what always has been will never be again,—that men and nations have cast aside their selfish feelings, desires and passions? As President Coolidge said a few weeks ago: "Though ultimately I believe that peace will prevail, I have too much knowledge of the history of mankind, and too much experience with the traits of human nature to dare assert that we shall never again be engaged in war."
—Honorable Dwight F. Davis, Acting Sec'y of War.

The Battles of Ludendorff On the Russian Front*

By General Hubert Camon, *French Army*

Translated by Captain E. M. Benitez, C. A. C., and reprinted by special arrangement with Berger-Levrault, publishers of *Revue Militaire Generale*

THE BATTLE OF LODZ

November, 1914

THE so called battle of Lodz was nothing but a series of chaotic combats, wherein Ludendorff put into execution Napoleon's maneuvers against the rear of the Russian forces, which towards the latter part of October, 1915, were deployed in a circle of 150 kilometers at the west of Warsaw.

These maneuvers have already been analyzed, but in order to understand the combats to better advantage, we will review them briefly.

It will be remembered that after the offensive of the IX German Army against Warsaw, which eventually developed into a Russian retreat, the Grand Duke Nicholas was advancing at the head of the 2d, 5th, 4th and 9th Armies to invade Silesia.† The Russians made a halt in order to repair their supply railways, and Ludendorff not being able to stop the Grand Duke by opposition against the latter's front, conceived the idea of taking advantage of the Russian halt to transport his IX Army to Thorn, reinforce it there and then direct it across the Russian supply railways at Warsaw thus cutting off the Russian supply lines. It should be borne in mind that the Russians, threatened by lack of food supplies and ammunition, had hastily fallen back in order to retain possession of their lines, and that with the IX Army in good control, it was possible for the Germans to shatter the scattered Russian corps that were marching in disorder.‡

* In three parts, of which this is the third, the preceding parts having been published in the August and September issues of the Journal.

† Translator's Note: Silesia was the great industrial center, which supplied arms and munitions to the German Armies.

‡Napoleon has written in regard to the maneuver of Smolensk in 1812: "If the French Army had surprised Smolensk, we could have crossed Borysthene and attacked the scattered and disorganized Russian Army." On April 19, 1809, Napoleon explained to Massena the maneuver which he directed from Pfaffenhausen towards Lanshut, against the line of operations of the Archduke at the Isar, in the following manner: "This is the true state of affairs. Prince Charles, with his entire army, was at one day's march from

It was necessary that the preparation and execution of the maneuver be prepared both so secretly and rapidly that the blow of the IX Army would take the Russians by surprise and not give them time to prevent it. Thus by putting them in an unexpectedly dangerous situation, it would cause the demoralization which would bring about their defeat.

In all his maneuvers against rear of armies, Napoleon's first thought was to seize in rear of the enemy either a river or a defile, in order to cut off the enemy's retreat at a small cost, leaving available at the same time the bulk of his forces. Examples of this barrier are: the Adda (maneuver of Lodi); the Stradella (defile) in 1800; the Lech, 1805; the Saale, 1806; the Isar, 1809. It also

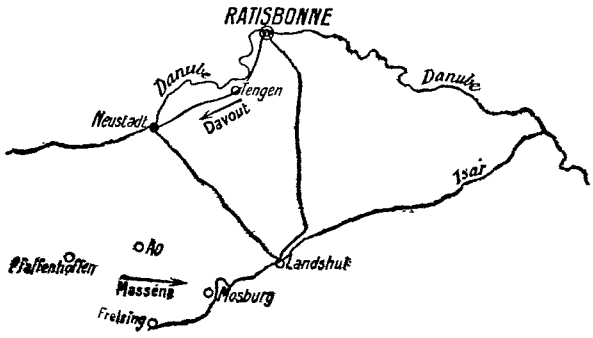

FIG. 11

served as a line of defense for the observation corps, which in his combats, Napoleon always held to check any enemy reinforcements. He had this plan in mind in 1809 at the Isar, when he ordered Bernardotte's corps and the Bavarians, to take the role of observation troops to the east of the river facing Munich.

Let us proceed with the maneuver of Lodz.

Before coming up on the rear of the Russian forces,* the IX Army had to cross the two principal enemy lines of supply and then find a line of defense where, if necessary, it could resist the attack of these Russian forces which were retreating in disorder towards

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Ratisbonne this morning. and his line of operations was in the direction of Lanshut. The Duke of Auerstaedt evacuated Ratisbonne. during the night and morning. in order to move on to Neustadt and join the Bavarians. You may now see why. due to this maneuver. I hold my left, desiring the advance of the right under your command. * * * Tonight or tomorrow we will fight. probably at our left. Move the corps of Oudinot towards Au and Freising. Whether you will be ordered to move from there. depends upon the reports that I may receive today. After you have advanced upon Lanshut. Prince Charles will then discover that he has lost his line of operations. as well as the Isar which is his protection. while at the same time he will be attacked on his left. Everything here depends upon our calculation of hours."

* The 2d and 5th Russian Armies were the only ones whose lines ran to Warsaw. The lines of the 4th and 9th Armies extended towards Ivangorod. and Ludendorff depended upon the Austrian offensive for their retention at this front.

Warsaw. This line of defense would, at any rate, serve as observation corps, in order to check the Russian reinforcements sent from Warsaw and prevent them from falling upon the rear of the IX Army.

Ludendorff chose the Rawka as his line of defense. This river is a tributary to the Bzura and flows by Skierniewice, north of the Brzeziny region, where the IX Army was to be sent.

"From the critical situation in Silesia and East Prussia," writes Hindenburg, "we were to be released by the offensive of the IX Army in the direction of Lodz against the flank of the Russian main mass which was only weakly protected. It is obvious that if the attack of this army did not get home quickly, the enemy masses would concentrate upon it from all sides. The danger of this was all the greater because we were not numerically strong enough, nor were our troops good enough in quality, to pin down the Russian forces in the bend of the Vistula, as well as the enemy corps north of the middle Vistula, by strong holding attacks, or indeed mislead them for any considerable length of time. In spite of all this we intended to make our troops attack everywhere, but it would have been a dangerous error to expect too much from this.

"Everything in the way of good storm troops had to be brought up to reinforce the IX Army. *It was to deliver the decisive blow.* However great was the threat to the VIII Army, it had to give up two corps to the IX Army. Under these circumstances it was no longer possible to continue the defense of the recently freed province on the Russian side of the frontier; our lines had to be withdrawn to the Lake region and the Angerapp. This was not an easy decision. As the result of the measures of which I have spoken the total strength of the IX Army was brought up to about five and a half corps and five cavalry divisions. Two of the latter had come from the Western Front. In spite of our earnest representations, Main Headquarters could not see their way to release further units from that side. At this moment they were still hoping for a favorable issue to the Battle of Ypres."—HINDENBURG, "Out of My Life."

Ludendorff based his calculations upon the strategic deployment of the Russian Armies (See map showing the maneuver of Lodz).

The German troops were arranged from north to south, as we have seen, as follows:

Demonstration Group: (Right shore of the Vistula) north of Mlawa: Zastrow Corps, Guard Reserve Corps (less three divisions) and three landwehr divisions; from south of Mlawa to Thorn: detachments formed by the troops withdrawn from the garrison of Thorn and Gaudenz.

Left Flank: I Reserve Corps (General von Morgen), concentrated at Hohensalza, was to skirt the right shore of the Bzura in the general direction of Lowicz.

Assaulting Mass (Masse de choc). Left Wing: The XXV Reserve Corps, 3d Guard Reserve Division, Richthofen's Cavalry Corps

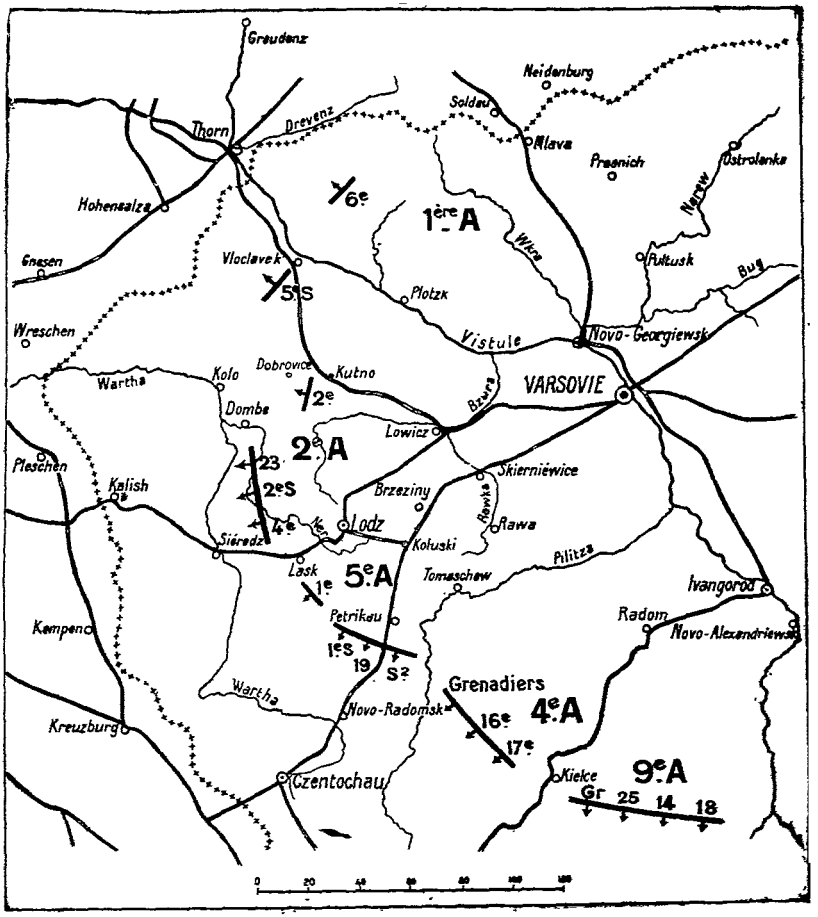

FIG. 12

(6th and 9th Cavalry divisions) in the general direction Kutno-Lowicz-Skierniewice; *Right Wing*, the XX, XVII and XI Corps, in the general direction Kolo-Dombe-Lodz.

Right Flank: Frommel's Cavalry Corps (5th and 8th Cavalry Divisions, and the 7th Austro-Hungarian Cavalry Division).

Screen: Between Pleschen and Kreuzburg: The corps of Posen and Breslau; in front of Kreuzburg, the 35th Reserve Division and the Bredow landwehr division; in front of Czentochau, Woyrsch's landwehr corps, with its right reinforced by the 1st Guard Reserve Division.

Finally, in the region to the north of Czentochau: General Boehm-Ermoli's corps, composed of the four infantry divisions and three cavalry divisions, sent by General Conrad.*

The X Army was to follow the line Thorn-Kutno-Lowicz, to assure its supply. The left of the mass of maneuver had to cover nearly 150 kilometers, before reaching the Brzeziny region. In order to open up this route, it had to crush the Russian flank guard, composed of the 5th Siberian Corps, south of Wloclawek and the 2d Russian Corps to the south of Kutno.

After having accomplished this, it had to organize its supplies, and repair the railways, which had probably been put out of service.

Ludendorff, in his calculations, could hardly have expected the left to arrive the Brzeziny region before the tenth day, but the cavalry with a small infantry, could have done so before the above mentioned day.

Let us see how Ludendorff viewed the plan of the Russians.

The 2d Russian Army was at about 75 kilometers from the Brzeziny region and could make this journey in five days. But Tannenberg had clearly demonstrated that the Russian Command was not fully developed in a strategic sense, and it would take, therefore, from two to three days for them to see the German maneuver. Then it would have to cancel the planned counter offensive towards the southwest, which was due to commence on the 14th, and also to organize the defense against the German maneuver. Since the right of the mass of maneuver would retain the corps of the 2d Russian Army and the "screen" those of the 5th Army, Ludendorff could reasonably expect that it would take at least five days before the 2d Russian Army could start towards Brzeziny, and by this time the left of the German mass of maneuver would be in front of it.

Richthofen's cavalry, supported by infantry, was to stop the Russian reinforcements sent from Warsaw and from the right shore of the Vistula as far north as possible, and was also to destroy the railways leading to Warsaw and as close to this city as possible.

The mass of maneuver had to be provided with a strong cavalry contingent, because it was the cavalry that was to stop the reinforcements from the north and also to destroy the Russian depots.

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* TRANSLATOR'S NOTE: General Conrad von Hotzendorff was at this time Chief of the Austro-Hungarian General Staff.

Ludendorff thought he could succeed and had these reasons upon which to base his belief:

1. His audacity.
2. The mediocrity of the Russians.
3. The secret code which would permit him to be informed of all the dispositions of his adversary.

"By November 10th," writes Hindenburg, "the X Army was ready. On the 11th it was off, with its left wing along the Vistula and its right north of the Warta. It was high time, for news had reached us that the enemy also intended to take the offensive. An enemy wireless betrayed to us that the armies of the northwest front, in other words, all the Russian Armies from the Baltic to, and including Poland, would start for a deep invasion of Germany on November 14th. We took the initiative out of the hands of the Russian Commander in Chief, and when he heard of our operation on the 13th he did not dare to venture on his great blow against Silesia, but threw in all the troops he could lay hands on to meet our attack. For the time being Silesia was thus saved, and the immediate purpose of our scheme was achieved. Would we be able to go one better and secure a great decision? The enemy's superiority was enormous at all points. Yet I hoped for great things."—HINDENBURG, "Out of My Life."

Let us read Ludendorff's brief account, before entering into the details of the combats.

"The Russians were taken completely by surprise, but even in the early days of our advance there was very heavy fighting, extremely expensive to both sides, near Wloclawek, Kutno and Dombe. The enemy was thrown back everywhere.

"While the main body of the IX Army pushed forward unceasingly to the Lodz-Kiliuszki Station line, General von Morgen covered their flank north of Lowicz with the I Reserve Corps. He was sorely pressed. At first he had to rely for protection on his own vigorous attacks, and then he had to meet an attack from a Russian corps which had crossed from Novo Georgievsk to the left bank of the Vistula. Due to the pressure exerted towards Mlawa by Zastrow's corps, the advance of this Russian Corps proceeded very slowly.

"The centre of the IX Army, von Richthofen's cavalry corps, the 3d Guard Division and the XXV Reserve Corps finally broke the resistance offered them. It now crossed the Lowicz-Lodz line and pushed far to the south past Brzeziny, their attention fixed on the south and west, striving after a great success. An order from the IX Army, of which I also knew, to secure its flank at Skierniewice, did not reach them. Army Headquarters was not far enough forward.

"The XX, XVII and IX Corps, which were huddled up, met a strong hostile force north of Lodz on the 17th, and engaged it. Frommel's Cavalry Corps and the Posen Corps advance but slowly on the east bank of the Warta.

"An intercepted wireless revealed to us that the Russians thought of retreating from Lodz. Our satisfaction was great. But the strong will of the Grand Duke held his forces where they were, as we learned from another wireless. We suffered a severe disappointment.

"The Russian troops on the right bank of the Vistula, with the exception of certain units which were to remain near Mlawa, were ordered to cross the Vistula. It was a good thing, that this operation was effected somewhat slowly; otherwise General von Morgen's position would have been still more difficult.

"The defeated Russian forces retreating through Skierniewice on Warsaw, were concentrated due west of the fortress, from which they were to resume their advance.

"The Russian right wing concentrated around Lodz. Reinforcements from the front of the 2d and 5th Russian Armies, which were not yet involved, pushed north on Koluczky and west of Lodz." —LUDENDORFF, "My War Memories, 1914-1918."

After having seen the general situation, as given by Ludendorff, let us go into its details.

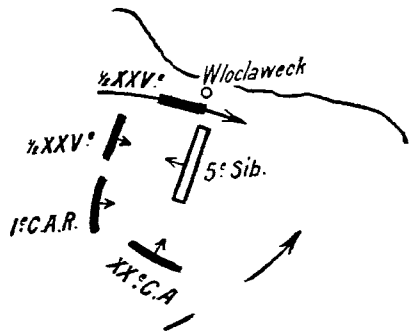

FIG. 13. COMBAT OF WLOCLAWEK

THE COMBATS

NOVEMBER 13. COMBAT OF WLOCLAWEK.—General Mackensen began operations on the 11th of November.

On the 12th, he attacked the 5th Siberian Corps in an oblique direction, south of Wloclawek, with the intention of enveloping it with three Corps: the XXV, XX and I Reserve. Richthofen's cavalry would surround the Russians by the south and cut off their retreat.

The operation was poorly conducted. The XX Corps came too close on the I Reserve Corps, thus permitting the 5th Siberian Corps to escape from disaster by executing a prompt retreat on Plotzk.

At Plotzk, this Russian Corps found the 6th Siberian Corps stationed on the right shore of the Vistula. This corps crossed the river and came to its help.

The I Reserve Corps (General von Morgen) was therefore immobilized due to a faulty execution of a battle of Cannae. The failure of the combat of Wloclaweck was one of the causes of the failure of the whole maneuver.

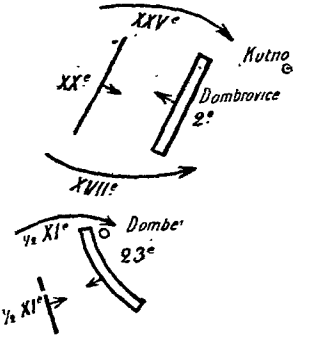

FIG. 14. COMBATS OF DOMBROVICE, DOMBE AND KUTNO

NOVEMBER 13 AND 14. COMBATS OF DOMBROVICE AND DOMBE. —Mackensen attacked the 2d Corps to the west of Kutno, intending to envelop it with the XXV, XX and XVII Corps and Richthofen's cavalry that had returned from the pursuit of the 5th Siberian Corps.

During this time, the XI Corps was holding off the 23d Russian Corps.

The 2d Russian Corps was repulsed towards Kutno.

NOVEMBER 15. COMBAT OF KUTNO.—On the 15th of November, the XXV and XX Corps reattacked the 2d Corps, which taking a new position in front of Kutno, had held the German Corps in check throughout the day. During the night, however, Richthofen with his cavalry entered Kutno by surprise. This decided the 2d Corps to retreat on the 16th. The attack against the Russian 2d Corps, was, evidently, not well executed. The German corps were too close to each other.

NOVEMBER 16.—On the 15th, Mackensen left the pursuit of the 2d Corps to the XX and XXV Corps and to Richthofen's cav-

alry and threw the XVII Corps against the 23d Russian Corps, which had already been attacked by the XI German Corps.

General Scheidemann, Commander of the 2d Russian Army, having witnessed the violence of the attacks of November 13 and 14 against the 2d Corps, reinforced the right of the 23d Corps with the 4th Corps. These two Russian Corps, the 4th and 23d, checked the efforts of the XVII and XI German Corps and the 3d Cavalry division on the 16th.

On the evening of November 16th, the 6th day of the offensive the IX German Army was on the line Dombe-Plotzk, at 80 kilometers

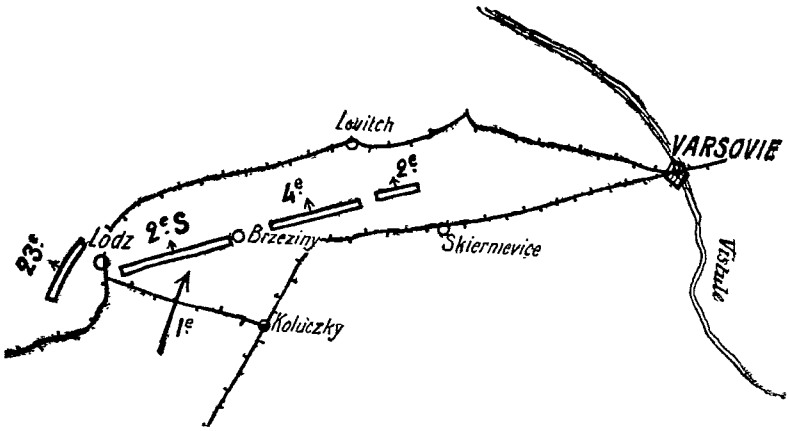

FIG. 15. PLAN OF THE GRAND DUKE

from its point of departure. But the booty was relatively small, and consisted of 25,000 prisoners, 20 guns and 70 machine guns.

COUNTER-DISPOSITIONS OF THE GRAND DUKE.—As soon as the Grand Duke Nicholas saw through the German maneuver, that is to say, probably on the evening of the 14th, he devoted himself to the preparations of the necessary steps to oppose his adversary. His idea was, apparently, to establish his front from Lodz to the Rawka ahead of the Warsaw-Koluczky railway. This railway was indispensable for the supply of his troops. This front was to be established from west to east as follows: West of Lodz, the 23d Corps; at Lodz, the 2d Siberian; then the 4th and 2d Corps. At the right of the 2d Corps came the reinforcements that were to be sent from Warsaw.

The entire 5th Army would come to the help of the 2d.

The Russians spent the 17th and 18th bringing up the 2d Corps to its new front. The rear guard covering the retreat of this corps stood violent attacks by the German "screen."

During these days, the two wings of the German IX Army became separated. The left (Richthofen's Cavalry Corps, 3d Guard Division, and the XXV Reserve Corps), having pushed to the east the remnants of the 2d Russian Corps, broke through Brzeziny as far as Koluczky.

Mackensen's wish was that these forces would establish themselves on the Rawka in order to intercept the retreat of the Russian forces towards Warsaw. But these orders were never received. They should have been given, however, previous to the advance. The German right (XX, XVII and XI Corps), in turn, after outflanking Lodz instead of obliquing towards the east in order to join the left wing and with it form the barrier, concentrated against Lodz.

THE BATTLE OF LODZ, NOVEMBER 19, 20 AND 21. (See Map). —The battle of Lodz took place on November 19, 20 and 21. The left wing of the XI Army assaulted the positions that were covering Lodz from the east and the right assaulted those at the west.

On the 21st, the Posen Corps and the 38th Infantry Division attacked to the north of Lask, in order to retain or at least to retard the 5th Russian Army, that was coming to assist the 2d Army. These German forces were repulsed by the 19th Russian Corps, which drove them to the west.

NOVEMBER 22.—On November 22d, the left of the German IX Army, which had not been able to effect junction with the right, was in turn attacked by the Russian Corps that were coming up from the south and the forces which had retreated towards Warsaw, and were now advancing towards the west. It was encircled and cut off from the German right.

NOVEMBER 24-25.—On the night of November 24-25, after bloody combats, the IX Army succeeded in not only piercing the encircling center, but also in making a large number of prisoners and collecting a large booty. The lack of ammunition in the Russian armies was already beginning to make itself deeply felt.

Mackensen established his corps so as to form a more or less continuous front from the Vistula to the north of Lodz.

The maneuver had ended and Silesia had been saved, but the annihilation of the Russian right west of the Vistula had not been accomplished. Ludendorff in his "War Memories," briefly summarizes it as follows:

"The IX Army executed an enveloping movement by immediately moving on to the east of Lodz; but as there was no counter pressure from the west, that is to say, from Kalisch, nor sufficient

cover in front of Warsaw, the Russians, coming from that portion of their front that had not been attacked and also from Warsaw, fell, in turn, upon the IX Army that was attacking from the north, and seriously pressed our forces. The German enveloping wing extricated itself from this situation by the heroic break-through at Brzeziny."

In fact, the success of the operation demanded that it be rapidly conducted. Similar to the Napoleonic maneuver at Lanshut, "everything depended on the speed of action." But Mackensen remained at Hohensalza, and Ludendorff following the traditions of the German General Staff, did not intervene in the execution.*

The situation, during the first days of December when the corps withdrawn by Falkenhayn from the Western Front (III R. II, XIII and XXIV R) arrived in Poland, did not permit Ludendorff to use these troops for a new maneuver. They were used to stabilize the front that had been considerably advanced in the direction of Lodz. This advance caused the Russians to abandon this important industrial center on December 6th. The left of the IX Army captured Lowitch and the front was pushed forward to the flats of the Bzura.

It is hardly an exaggeration to think that if Ludendorff had been able to begin his maneuver with one additional corps, or two at the most, or if the attacks against the 5th Siberian Corps and 23d Russian Corps had been conducted better, and if the role of the left wing had been more clearly indicated and understood before the commencement of the maneuver, the success of the operation might have been complete and the Russians would have been tied up for several months.

It would, undoubtedly, be very interesting to make a detailed study of the Battle of Lodz on November 19, 20 and 21, and compare it to the Napoleonic battles based on similar maneuvers, against the enemy rear, as Lena and Eckmuhl. But the documents are lacking.

THE WINTER BATTLE IN MASURIA (BATTLE OF AUGUSTOWO)

FEBRUARY 7-21, 1915

The campaign of 1914 did not bring about the decision of the war on the Western Front as sought by Moltke and Falkenhayn.

* Ludendorff bitterly reproaches himself for this. In regard to the offensive of March 21, 1918, he writes in his "War Memories": "Bearing in mind the campaign of 1914 in Poland, I have tried to exert the greatest influence in the battle, and this is a most delicate question when only one group of armies is involved. The immediate superior authority may be easily charged in such a case with needless meddling. We will use two army groups in the 1918 offensive, that of Prince Rupprecht and that of the Crown Prince, so that we may be reserved the right of intervention."

Towards the latter part of December, 1914, the Russians reached the Carpathian mountains and General Conrad, the Chief of Staff of the Austrian Army, requested the aid of the Germans in the great offensive that he was contemplating.

Falkenhayn decided to form the German Southern Army in the Carpathians, which was to be commanded by General Lizingen with Ludendorff as his Chief of Staff.

Hindenburg, however, energetically pointed out the peril to which East Prussia would be exposed in case of a withdrawal of troops and asked the retention of Ludendorff.

Returning from Posen towards the end of January, Ludendorff was informed that four new corps had been assigned to his Commander in Chief, in order to destroy the 10th Russian Army, which was a constant menace to East Prussia.

The 10th Russian Army commanded by General Sievers, consisted of four corps, from right to left as follows: 3d, 20th, 26th and 3d Siberian. Two of the four divisions of the 3d Corps were mediocre. The army itself was organized along the line Wilkowiski-Johannisburg, a front of 100 kilometers. Tilsit and Memel were occupied by the Russians.

How were the Germans going to get rid of the 10th Army?

Hindenburg and Ludendorff laid aside this time the Napoleonic scheme, with which they had only attained a partial success in the Battle of Insterburg (Masurian Lakes), and decided to adopt the scheme of Cannae, which had given them the brilliant victory of Tannenberg. Let us then follow Hindenburg and Ludendorff:

"At the beginning of the year, four army corps were placed at our disposal and transferred from home and the Western Front. They were detrained in East Prussia. Part were to reinforce the VIII Army and part to form the X Army under General von Eichorn. They deployed and separated with a view to breaking out from both wings of our lightly held entrenched position from Lotzen to Gumbinnen. The 10th Russian Army of General Sievers was to suffer deep envelopment through our two strong wings which were to meet ultimately in the East on Russian soil and thus annihilate to a great extent everything the enemy had not got away.

"The fundamental idea of the operation was put into the following words for our Army Commanders on January 8,* while we were still at Posen: 'I intend to employ the X Army, with its left wing along the line Tilsit-Wilkowiski, to envelop the enemy's northern win· , to tie him down frontally with the Konigsberg Landwehr Division and the left wing of the VIII Army, and employ the

* TRANSLATOR'S NOTE: The author evidently means January 28.

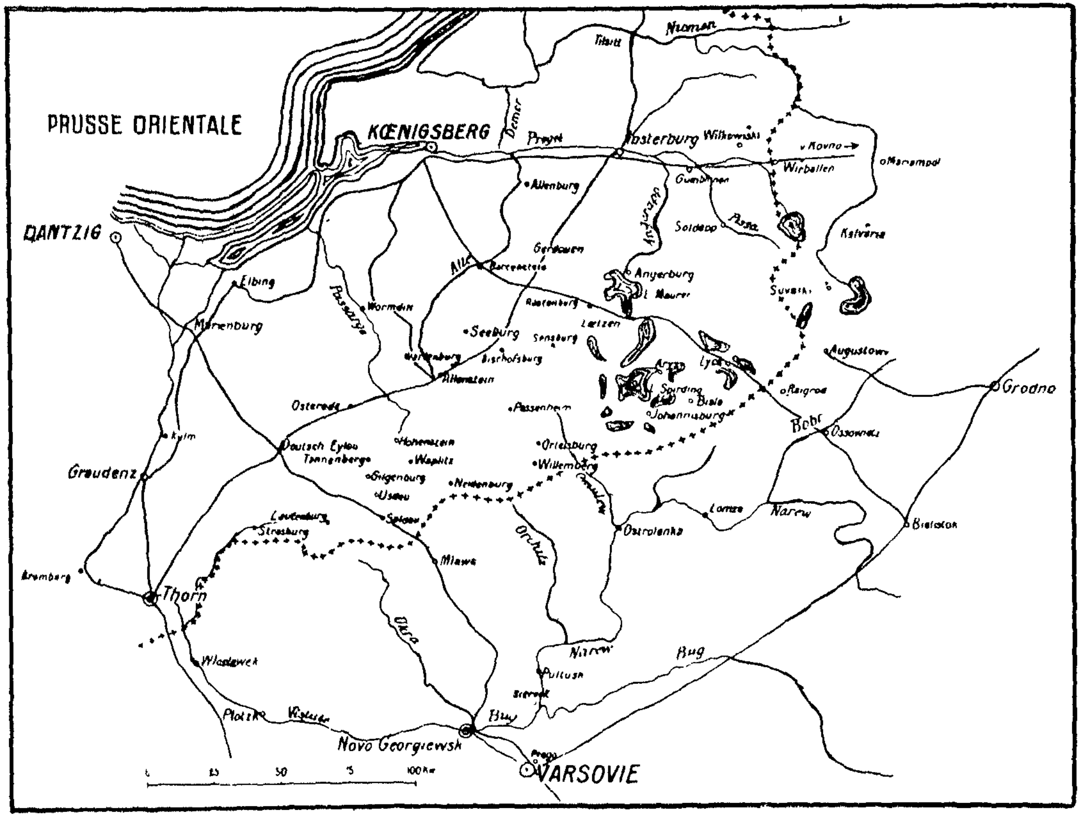
PRUSSE ORIENTALE
KŒNIGSBERG
DANTZIG
Elbing
Marienburg
Graudenz
Thorn
Wloclawek
Plotzk
Novo Georgiewsk
VARSOVIE
Insterburg
Tilsitt
Niemen
Wirballen
Kovno
Gumbinnen
Soldau
Allenburg
Gerdauen
Angerburg
Seeburg
Allenstein
Osterode
Deutsch Eylau
Tannenberg
Hohenstein
Ortelsburg
Willemberg
Neidenburg
Mlawa
Strasburg
Lautenburg
Ostrolenka
Lomza
Narew
Bug
Bobr
Ossowetz
Augustow
Grodno
Bialystok
Johannisburg
Lyck
Passenheim
Pultusk
Passarge
Wormditt
Bischofsburg
Lötzen
Rastenburg
Raigrod
Kalvaria
Mariampol
Suwalki
Kulm
Bromberg
Orzhitz
Wkra
100 km

FIG. 16

right wing of the VIII Army for an attack on the Arys-Johannisburg line and south thereof'."—HINDENBURG, "Out of My Life."

"The experience of Tannenberg and the great battle of the Masurian Lakes," writes Ludendorff in his War Memories, "had shown us that a great and rapid success in battle was only to be obtained when the enemy was attacked on two sides. We now had the possibility of carrying out two enveloping movements, one from the Tilsit-Wladislavow-Kalvaria direction with a strong group of three corps (which were to be assembled between the Niemen and the road from Insterburg to Gumbinnen), and another with the XXXX Corps (Reserve), to which the 2d Infantry division and the 4th Cavalry division were attached, between Lake Spirding and the frontier from the direction of Bialla-Raigrod-Augustowo and the south. Simultaneously, the enemy was to be pinned down by a frontal attack.

"Both our opponent's wings were weak. We could hope to gain a lot of ground before the enemy forces could get away from our frontal attack. Our two thrusting wings would then surround the enemy.

"Our flank protection from Kovno and Olitta on one hand, and Ossowietz and Lomza on the other, was to be mainly assured by units of the VIII Army, which would become available due to the narrowing of front as a result of the convergence of our two flanks in a common directed towards Grodno."

The month of January was dedicated to the preparation of the operation. The troops were not moved until the last moment.

"We feared," writes Ludendorff, "that the withdrawal of troops on such a large scale from occupied Poland could not be kept secret, and might disclose our plan for an offensive in East Prussia. I attached the utmost importance to secrecy for the success of our operations."

FEBRUARY 5.—The concentration was completed on February 5th. The German General Headquarters were moved to Insterburg on this date.

"On February 5th, precise battle orders were issued from Insterburg, whither we had gone to direct the operations. From the 7th onwards, they set in motion the two groups on the wings, a movement recalling in some respects our celebrated Sedan."—HINDENBURG, "Out of My Life."

The participating forces were divided, from north to south, into two armies: the X Army (General von Eichorn) and the VIII Army (General von Below), with Darkehnen as the separating point.

The following order was issued:

(a) The flanking corps of the Niemen (landstrum of Konigsberg) must seize Tilsit and assure the line to the Niemen.

(b) Northern Enveloping Mass: the X Army, composed of three corps (XXI, XXIX and XXXVIII), the 1st Cavalry Division and the 5th Guard Brigade.

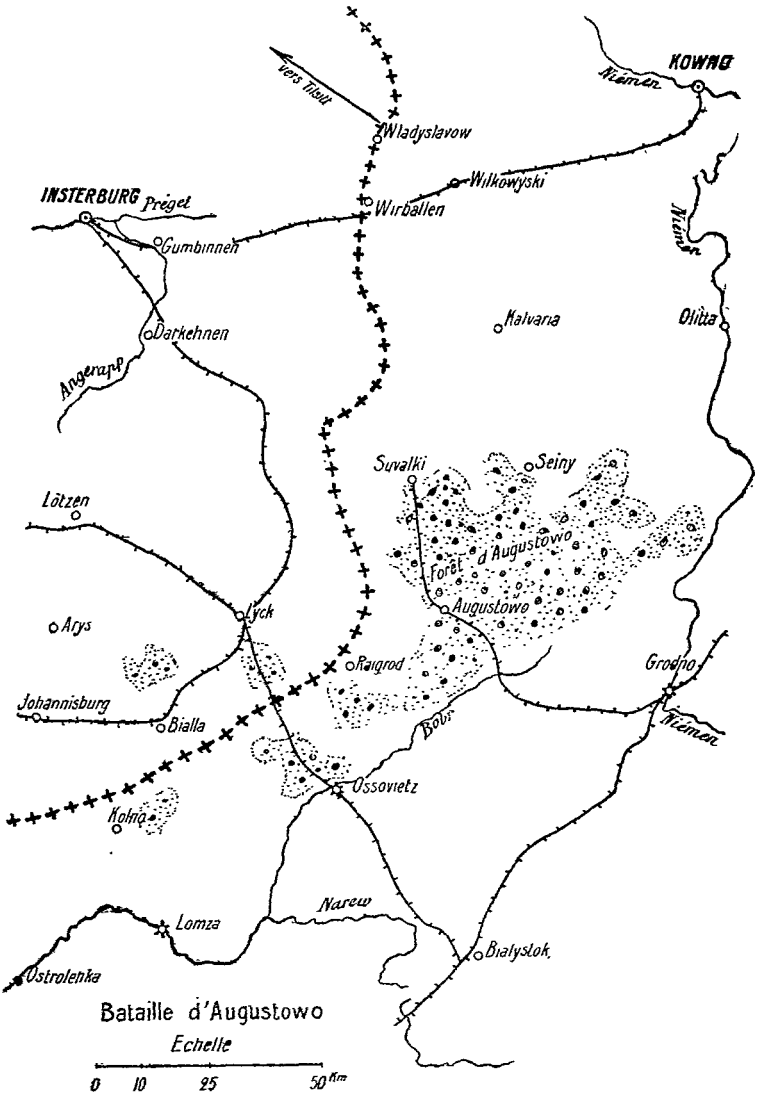

FIG. 17. THE BATTLE OF AUGUSTOWO

The landwehr division of Konigsberg is on the road to Insterburg.

(c) Front: From the Insterburg road to Lake Spirding. It comprises the 2d Reserve Division and 3d Landwehr Division, strongly combined with landstrum and five infantry brigades.

(d) Southern Enveloping Mass: Furnished by the VIII Army. It comprises the 2d Infantry Division west of Johannisburg with the XXXX Corps to its south and extending to the frontier. The 4th Cavalry Division will concentrate to the rear. The XX Corps, detached from the IX Army, will debark at Ostelsburg to be transported to Lomza, in rear of the southern mass. This corps must advance towards the Narew through Mychnietz.

(e) Southern Flanking Corps: Facing Lomza, under the command of General Ascholtz.

(f) Cover between the Orchitz and the Vistula: Army detachment under the command of General von Gallwitz, which must advance to the south as soon as assembled. Thereafter, the best cover in this region will be furnished by the offensive of the VIII and X Armies.

It should be noted that the northern mass consisted of three corps and one cavalry division, while the southern mass only consisted of one and a half corps and one cavalry division.

"I did not find it easy to start the army off on its task," writes Ludendorff. "The winter was cold. An exceptionally fierce snowstorm had been raging since the 4th or 5th of February; roads and railways were buried, and it was difficult to get ahead off the beaten track. Snowdrifts, as high as a man, were succeeded by bare places covered with thin ice. However, no alteration was made in the original scheme. The Russians had even greater difficulties to contend with, because their supply trains had been sent on ahead.

"Our troops were equipped for a winter campaign, and the mortars had been provided with snowshoes, though these proved later to be unpractical, for they could not be used on roads which were only covered with snow in places.

"The feats performed by man and horse during the following days are beyond description. * * * It was lucky that by our wide encircling movement we captured provisions from the enemy's provision columns, for otherwise the whole operation would have had to be broken off through failure of supply.

"The commands and the subordinate staffs had to face extraordinary difficulties. It was a long time before the battle-worthy units could be brought up when an engagement with the enemy took place. Orders could not be transmitted, wires were broken down by the storm and messages did not arrive."—LUDENDORFF, "My War Memories, 1914-1918."

THE BATTLE, FEBRUARY 7-21.—The Russian Army was taken by surprise.

"Our intelligence service," writes Ludendorff, "did good work by spreading false rumors and preventing the enemy from obtaining information."

SOUTHERN ENVELOPING MASS.—On the 7th, General Litzman arrived in front of Johannisburg with the right wing of the VIII Army. On the 8th he took Johannisburg, and with his flank secured against any enemy movement from Ossowietz, pressed forward to Raigrod, where he met with strong opposition. At the same time, the left wing of the VIII Army, following close on the heels of the enemy, was approaching Lyck.

Lyck, which was splendidly defended by the 3d Siberian Corps, fell on the morning of the 14th. This corps escaped annihilation and withdrew via Augustowo behind the marshes of the upper Bohr.

By the night of the 16th-17th, General Litzman was in Augustowo after further heavy fighting.

NORTHERN ENVELOPING MASS.—Its maneuver was "perfectly executed."

"By the night of the 10th-11th, after extraordinary forced marches and incredible efforts, the centre of the X Army, moving on the Tilsit-Kalvaria line, had reached the Insterburg-Kovno road near Wirballen. The 3d Russian Corps escaped to the north, instead of towards the centre and the X Army permitted its escape.*

"On the 14th, when Lyck fell, our infantry columns were already due north of the great Augustowo forest near Suwalki-Seiny. The retreating Russian Army was attacked vigorously in the flank and forced southwards.

"On the evening of the 14th it seemed as though it would be possible to complete the envelopment of the enemy due east of Augustowo. General von Eichorn diverted his left wing in this direction. On the 15th and 16th the advance guard of the XXI Corps advanced on the Seiny-Augustowo "chaussee" (road), far into the forest, but here they were overrun by Russian columns pouring back eastwards, and part of the German forces were made prisoners. Up to February 18th, forces of the 10th Army pushed on boldly along the northern edge of the forest to the vicinity of Grodno. Here they took up a position facing west with their rear close to the fortifications. This bold and venturesome movement cut off the enemy's retreat."—LUDENDORFF, "My War Memories, 1914-1918."

Other units of the X Army were plunging through the forest, joining the forces of the VIII Army, and closing the circle around the 10th Russian Army. This army was surrounded by German forces, but the situation of the German armies also had its difficulties.

"On the 20th and 21st, violent attacks were made from the fortress of Grodno, where the Russian reinforcements had assembled.

* The retreat of the 3d Russian Corps was similar to that of the 5th Russian Corps at Tannenberg.

The Russians also made repeated attacks from the Augustowo Forest, into which they had poured in their retreat. The German troops stood firm, though suffering heavy losses.

"A few days later the masses of Russian troops surging in the Augustowo Forest and defending themselves desperately, surrendered. The battle was at an end."—LUDENDORFF, "My War Memories, 1914-1918."

"And," writes Hindenburg, 'it was indeed a Sedan which finally befell the Russian 10th Army in the region of Augustowo. It was there that our mighty drive came to an end on February 21st, and the result was that more than 100,000 Russians were made prisoners and an even larger number of Russians were killed. On the orders of His Majesty the whole affair was called the "Winter Battle in Masuria."—"Out of My Life."

"The tactical results of the winter campaign in Masuria were important: 100,000 prisoners and hundreds of guns. The Russian 10th Army had been annihilated and Russia's strength was once more perceptibly reduced."—LUDENDORFF, "My War Memories, 1914-1918."

CONCLUSIONS

Of the three battles conducted by Ludendorff in the Russian front from 1914-1915, the first—Tannenberg—was the scheme of Cannae; the second—Insterburg—was the Napoleonic scheme, and the third—Augustowo—was again the scheme of Cannae.

Ludendorff, in order to justify himself for his return to the scheme of Cannae, writes: "The experience of Tannenberg and the great battle of the Masurian Lakes had shown us that a great and rapid success in battle was only to be obtained when the enemy was attacked on two sides." Let us see whether or not Ludendorff is justified in his conclusion.

TANNENBERG.—Tannenberg was a brilliant victory, indeed. Ludendorff, with forces much inferior in number to Samsonov's army, was able to crush this army and take it, in part at least, prisoner. His judgment in the adaptation of the scheme of Cannae was sound. This consisted in shaking off the corps at the flanks and then encircling the three corps at the centre.

It must not be forgotten, however, that he had exact knowledge of all the adversary's steps, which is a luck seldom had by any general. Moreover, the Russians placed themselves in front of him. Samsonov committed suicide instead of extricating himself from the encirclement by attacking one of the enveloping masses. The corps at the flanks, after being reorganized, only thought of putting them-

selves out of reach, instead of advancing against these German masses.

INSTERBURG.—Ludendorff decided to adopt the Napoleonic scheme, because having at his disposal only eight divisions against the Russians' twelve divisions (the latter also occupying a fortified line). He could not form the two enveloping masses of the scheme of Cannae. It is also probable that he was influenced in his decision by the French success at the Battle of the Marne.

The corps at the front, however, could not pin down the Russians. Rennenkampf only thought of retreating as soon as he saw the turning movement. He also left 45,000 prisoners and an immense booty in the German hands. It is possible that Rennenkampf would not have allowed himself to be surrounded by the scheme of Cannae. In order to accomplish this, it would have been necessary to put into execution a Napoleonic maneuver against the rear of the Russian Army, and this Ludendorff did not dare to undertake.

AUGUSTOWO.—At Augustowo, after several vicissitudes, the majority of the Russian 10th Army was made prisoner.

Judging from the successes of the battles of Tannenberg and Augustowo, we may be led to believe that Hannibal's scheme is more successful in modern warfare than Napoleon's scheme. It must be borne in mind that while the Russian troops made the Germans pay a good price for their successes, the Russian Command, however, did not seem to react, and also Ludendorff was perfectly informed of the enemy dispositions.

On the other hand, we have seen that in the combats which preceded the battles of Lodz, Wloclawek and Dombrovice, the Germans did not succeed in carrying out the scheme of Cannae, and that, first the 5th Siberian Corps, and afterwards the Russian 2d Corps succeeded in escaping.

With the aggrandizement of the battle front, the chances of an encirclement decrease, while on the contrary, the possibilities of the adversary being able to crush one of these turning masses in his efforts to keep off the other, increase.

The superiority of the scheme of Cannae, with the means of modern warfare is, therefore, a subject of contention.

EDITORIALS

Another Change

FOR the tenth time since the organization of the JOURNAL OF THE UNITED STATES ARTILLERY, more than a third of a century ago, its editorship has changed hands. The call of other duty, that intermittent but always-to-be-expected call which we all know, has taken Major Joseph A. Green, C. A. C., from the editorial desk to other fields of endeavor. During his too-brief period in charge of the destinies of the JOURNAL, Major Green has been eminently successful. In every department progress has been evident under his regime. To his instictive ability to produce a periodical interesting and instructive to its readers he added a business acumen which has placed the JOURNAL upon a sounder basis than ever before. The JOURNAL considers his departure as distinctly a loss, and feels that its readers will join with it in wishing Major Green the greatest of success in his future career.

The Shenandoah

Two years ago the naval dirigible *Shenandoah*, then the *ZR-1*, took the air at Lakehurst, New Jersey, on its trial run. Its construction had continued over a period of four years and it represented the last word in airships. The disasters to the *ZR-2* and to the *Roma* had contributed to the improvements in the *Shenandoah* In its design and in its construction, the utmost care had been exercised. So far as was humanly possible, this, our first attempt at large dirigibles, was a perfect product.

Throughout its career the *Shenandoah's* performances justified the confidence of its designers and builders. On short trips and long trips, in fair weather and foul it proved its air-worthiness. In no respect did it indicate forth-coming disaster, and yet disaster was its end. On a recent trip to the west, while over Ohio, the *Shenan-*

doah, without warning, broke into three parts and crashed to earth, with the loss of life of its commander, Zachary Lansdowne, and a number of other members of the crew.

The Navy Department is conducting an inquiry into the cause of the wreck, and until its findings are published it would be idle to speculate on the cause of the disaster. Testimony of witnesses is conflicting. Experts do not yet agree on the probable points of weakness,—whether they be too few safety valves, incorrect bracings, disintegration of structural materials, or other cause; and until the cause of the disaster is determined, lessons cannot be drawn therefrom. That there are lessons is unquestioned. In the air service, as in other lines of endeavor, we learn by our mistakes; and in the air service, as in other lines, we continue to progress despite mistakes. Other countries have lost airships and are continuing to construct other airships. We shall undoubtedly do the same; and we may anticipate having before long in the Navy, or in the Army, or in some other service, airships better constructed and better performing because of the loss of the *Shenandoah*.

To our sister service in her hour of loss we extend our utmost sympathy. To the families of the heroes who met their death in the wreck we can only say in consolation: "They died in line of duty."

Rating Coast Artillery Organizations

The question of changing the present method of rating Coast Artillery Organizations is being considered in the office of the Chief of Coast Artillery. It is realized that if a satisfactory method of awarding a figure of merit for excellence in gunnery could be devised, and the same published annually in orders, it probably would result in better trained units and better preparation for war conditions.

At present, ratings of Target Practices only are made in the office of the Chief of Coast Artillery, and are based on a study of the target-practice reports and the information and recommendations contained in the forwarding indorsements thereon. A recent Bulletin showed that, for the 1924 target practices, 10 batteries were rated excellent; 35 very good; 178 satisfactory; and 23 unsatisfactory. These ratings, however, do not show the relative merit of the batteries in the various classifications,—a necessary condition if real competition is to be had.

The rating of Coast Artillery Organizations is now made by the Coast Artillery District Commanders in compliance with paragraph 35*d* (2) TR 435-55 and includes Target Practice as one element of the general efficiency of the organization.

The JOURNAL realizes that many officers of the Corps have ideas of one kind or another on the question of rating. If the ideas of these various officers could be brought together, they might be of material assistance in determining a suitable method for arriving at a figure of merit, provided such a method were eventually decided upon. The JOURNAL will appreciate the opinion of any officer upon this subject.

Always Unready

[Reprinted from the *Detroit Free Press*]

In his final article of a series describing the activities of the American Army throughout the prevalent summer months, General Pershing makes a special plea for adequate national preparedness, remarking significantly that there is a great difference between a nation that believes in preparedness and a nation that is actually prepared.

This difference is fully demonstrated by the situation in the United States today. Despite the prevalence of a few pacifists, there is not the slightest doubt that America understands the need of adequate means of defense, and fully subscribes to the declaration by George Washington that "to be prepared for war, is one of the most effective means of preserving peace." That declaration indeed is impossible of contradiction by any person with eyes in his head. It is axiomatic. It has been repeated in words more or less similar by hundreds, both before and since the time of Flavius Renatus Vegetus, who gave it the classic phrasing: "Let him who desires peace prepare for war."

But General Pershing is strictly within the truth when he says:

> There never has been adequate preparedness in this country. We have come out of all wars with the best of intentions and high resolves henceforth to be prepared to preserve our peace and liberty. But those resolutions like those made by so many each New Year have always been broken. After each war, we have lapsed into our old habit of neglect. Temporary expediency has always tempted us to keep whittling down our military establishment. Always to our great surprise, war, with all its confusion and cost in lives has come to us, largely because of our weakness.

The record shows that General Pershing is right. Time after time we have been penny wise and pound foolish and have extricated ourselves from the result of our folly only at great cost both in lives and money. As Pershing puts it, "It is not economy to save thirty million dollars a year on national defense, and then spend thirty billions in two years during war."

It is true, of course, that the relapse into a fool's paradise has been less violent in the United States since the World War than it was on other occasions. The demoralizing efforts of the professional pacifists have to quite an extent been neutralized, and there is more general interest in preparedness among the rank and file of the citizenship of America than ever before. The success of the summer training camps and of the R. O. T. C. movement has been large, and if interest can be maintained, the result will be a comfortable presage to continuing peace, or at least of a preparedness which will carry us through a war at considerably less cost and suffering than otherwise.

But it also is true that the precautions which are being taken are far from adequate. That is indicated by the circumstance that General Pershing still finds it necessary to plead for a regular army establishment of at least thirteen thousand officers and one hundred and fifty thousand men as a first line of defense and as instructors of civilian soldiers. All the experts agree that this should be a minimum but congress pays no attention to the recommendations and warnings.

Self Protection

Self protection is instinctive with all of us. We, as human beings, seek to assure the continued existence, well-being and safety of ourselves, our families and our property. For that reason we carry life insurance, burglary insurance, fire insurance and accident insurance. In one department, however, we are prone to be negligent.

From figures recently released by the United Services Automobile Association, we find that, of the approximately 4,000 commissioned and warrant officers and field clerks of the Army, Navy, Marine Corps and Coast Guard Service insured in that association, 2,511 were involved in accidents. Of these, 2,505 claims were paid—an amount exceeding $50,000, while but six claims were disapproved.

A great majority of army officers possess automobiles and are reasonably skilful drivers; yet all are subject to accident. It is true, of course, that the ratio of automobile accidents to the number of automobiles in use is continually decreasing, but the rapidly increasing number of automobiles in use brings about an increase in the total number of accidents. This has resulted in proposals in more than one-half the states for compulsory insurance, which the JOURNAL, however, considers but an ineffective method of protection against loss.

It is important that the automobile owner protect himself and his family against the particular form of loss or damage, and to the particular extent which he feels necessary. Above all, he should be protected against personal liability. It is estimated that not more than twenty per cent of all automobile owners carry liability insurance, and it is further estimated that at least one-half of all owners involved in personal injury accidents are unable to meet a judgment in damages. A great many officers of the Army will fall under this latter class, and the JOURNAL, therefore, cannot recommend too highly the protection resulting from insurance.

More Annapolis and West Point Academies Needed

[Reprinted from the *Washington Herald*]

From time to time this newspapepr has set forth the nation's need for more naval academies like Annapolis, more military academies like West Point. This need never has been more imperative than it is today.

There is a common idea that Annapolis and West Point make only fighters. The idea is wrong. These two national academies teach young Americans not only how to defend their country in war, but also how to serve their country in peace. They teach American young men why this is a country worth defending, how the United States was built up to be the nation that it is today, what has been done and by whom to rescue it from a mere colonial existence like Canada's, who have made the sacrifices to save it from an arrested development like Australia's, why the nation is no loose cluster of States, like Germany, but a close and indivisible Union, and over and above all why, only by his whole-hearted loyalty and his single-hearted devotion, the good citizen can help preserve and perpetuate the institutions that safeguard the comfort, progress, well-being and liberty of all.

The National Guard

[Reprinted from the *Washington Star*]

The War Department has notified the national guard organization in 24 States, the District of Columbia and Porto Rico that they shall stop further recruiting as they have reached the strength for which funds were alloted them for the current fiscal year. From one point of view this is exceedingly satisfactory. What seems regrettable is that the patriotic willingness of the citizens of the United

States to serve in the national guard should have to be thus checked, as it is clear that if this step had not been taken to stop recruiting a still greater number of men would have come forward. An effective of 177,000 men seems a very small one for a country with a total population of over 110,000,000, as it represnts only one-sixth of 1 per cent of the population.

In Great Britain, with a population of less than 50,000,000, the territorial army, the organization corresponding to the national guard in the United States, numbered before the world war, over 300,000 men, or proportionately almost six times the peace effective of the national Guard. Small as this force was, it was of immense service to the country, as it enabled the military authorities to reinforce the expeditionary force of 150,000 men sent to France at the outbreak of the war by an additional 100,000 men within a few weeks' time. Small as this reinforcement was, it proved at that time to be of priceless value.

The plans of the War Department called for 80 American divisions on the Western front by June 30, 1919, and for a reserve of 18 divisions at home, a total of 4,850,000 men. All of the plans for training were built on this scale and at the signing of the armistice on November 11, 1918, these plans were in full operation. On August 7, 1918, the distinguishing characteristics of the Regular Army, National Army and National Guard were discontinued, and all the military forces of the Nation were united in the United States Army. In November, America had 31 per cent of the Allied troops in France, Great Britain had 28 per cent, and the French 41 per cent. The size of the Army had increased from 190,000 to 3,757,624 men, of which 2,086,000 reached France. In the Meuse-Argonne offensive, 29 American divisions were in line, upholding the finest traditions of the service. The Coast Artillery had grown in this time from 21,000 men to 137,000 in November, 1918.

PROFESSIONAL NOTES

Coast Artillery Training Activities—1925

EDITOR'S NOTE: *In a letter to the Adjutant General of the Army dated August 26, 1925, the Chief of Coast Artillery submitted the following review of Coast Artillery Training Activities for the Fiscal Year 1925. The* JOURNAL *considers these remarks of the Chief of Coast Artillery, together with his recommendations, to be of interest to all officers of the Coast Artillery Corps.*

GENERAL.—During the fiscal year 1925 the training of the personnel of the Coast Artillery Corps has been carried out in conformity with the War Department's Training Directives for 1924 and 1925. This conformity to War Department instructions has resulted in a marked improvement in all phases of regimental training, with but very few exceptions.

The good results in training have, nevertheless, been accomplished under most adverse conditions due to the following causes:

a. Insufficient training personnel now allotted to the regiments garrisoning the several harbor defenses within the continental limits of the United States.*

b. Training programs of a too comprehensive nature required to be carried out by the undersized regular regiments. These plans require the necessarily small firing batteries to be proficient in the use of two, and in some cases, three different classes of armament. These manifold duties are necessary in order that the National Guard and Organized Reserve regiments, the R. O. T. C. and C. M. T. C. personnel may be properly trained in the tactical empoloyment and firing of the different classes of armament.

c. Insufficient funds to provide the required artillery boat service in many harbor defenses, for use in the towing of targets and in the running of drill courses simulating the action of hostile war vessels in attacking land fortifications.

d. Lack of suitable airplanes carrying artillery observers, these planes being required for the towing of sleeve targets for the target practice of all antiaircraft artillery regiments.

e. Lack of the latest types of antiaircraft artillery materiel including guns, listening devices, and self-contained range finders.

f. An insufficient allowance of target practice ammunition for all firing batteries.

g. The large amount of non-military work required of the personnel of all regiments in the upkeep of military posts.

Training inspections have been made, under the provisions of A. R. 265-10, of all the regular regiments of the Coast Artillery Corps located in the conti-

* 3394 enlisted men in 19 harbor defenses within the United States.

nental limits of the United States by representatives of this office. These inspections have invariably brought out the fact that training programs now in vogue are of a too crowded character and in consequence of this fact regimental commanders find it difficult to maintain a high state of morale in their commands. These inspections have proved to be most beneficial due to the fact that the inspecting officers have done much to standardize the methods of instruction in the several regiments in accordance with the provisions of the latest training regulations.

GUNNERY.—A special effort has been made during the last training year to require all batteries trained to fire on naval targets to conduct target practice under the provisions of the new T. R. 435-221 "Fire Control and Position Finding." A similar effort has been made to standardize in accordance with the latest regulations, the fire of all antiaircraft gun and machine gun batteries.

The results of the firings against simulated naval targets indicate considerable improvement in this class of fire for the year. There has been an increase in the number of hits per gun per minute, and in the firing ranges, and a decrease in the times of making adjustments from observation of fire by battery commanders. However, there is still much room for improvement in this class of firings which can be accomplished only by the intelligent and untiring efforts of all officers of the corps on duty with the several regiments manning armament designed to fire on naval targets.

A new departure has been made consisting of the holding of one target practice in each Coast Artillery district during which the battery personnel is subjected to a gas attack. These firings have emphasized the need for gas masks suitable for the personnel operating telephones and optical instruments.

Under War Department instructions of April 18, 1925, exhaustive antiaircraft service training is now being conducted by the 62d Coast Artillery (AA) at Fort Tilden, New York, in conjunction with the Air Service personnel located at Mitchell Field, L. I., with a view to determining the efficiency of antiaircraft gun and machine gun fire against air targets and the ability of searchlights, directed on data furnished by listening devices, to pick up planes at night and to hold them in their beams. In order that a satisfactory volume of fire may be obtained, this training is being conducted by firing batteries, manning four guns and eight machine guns of the pattern now supplied to the service.

Up to June 30th the firings held at Fort Tilden have not been sufficient to permit the formation of an estimate of the degree of efficiency of antiaircraft fire. Practice is being held with sleeve targets towed by planes under conditions simulating as nearly as the required safety regulations will permit the actual conditions of war. However, the firings held by the 62d Coast Artillery (AA) and similar ones held during the year by other antiaircraft regiments of the Corps have shown that it is possible to hit the sleeve target with antiaircraft gun fire as often and with as small an expenditure of ammunition as is required by other classes of artillery in firing upon naval and land targets.

In order that a healthy rivalry in all classes of target practice may be stimulated throughout the Corps this office has issued tables showing the results of all firings of the regular regiments assigned to fixed, railway, antiaircraft, and heavy tractor drawn artillery materiel held during the calendar year 1924. It is believed that these tables will be the means of stimulating a healthy interest in the target practices to be held during the coming season.

Requests have been made to all regimental and artillery district commanders to submit reports at the end of each target practice season, covering in detail the results obtained at all practices held by the units of their commands and setting forth what steps they have taken to improve the methods and accuracy of fire.

It is only by a careful and intelligent supervision over all firing on the part of senior Coast Artillery officers that good results in gunnery may be obtained.

TACTICAL EMPLOYMENT.—The development of correct methods of tactical employment of the several classes of Coast Artillery units has received attention during the year.

In the majority of the harbor defenses, both in the United States and abroad, tactical problems involving the employment of all the elements of defense have been successfully solved from time to time, in connection with tactical inspections of superior officers, and during war condition periods, set to determine the efficiency of existing war plans.

At the Coast Artillery School, a special study is being made of the correct tactical employment of the units of the antiaircraft service assigned to field armies. This study includes matters pertaining to the organization of antiaircraft regiments, and the tactical control of the regiment and the brigade assigned respectively to the corps and army. I again desire to renew my recommendation made to the War Department on January 13, 1925, that the tactical control of the antiaricraft regiment in the corps and of the brigade in the army be directly under the commanders of these units and not exercised through the corps and army chiefs of artillery.

TRAINING REGULATIONS AND ARMY CORRESPONDENCE COURSES.—Satisfactory progress has been made in the preparation of Coast Artillery training regulations during the year with a special effort toward the preparation of these regulations pertaining to railway and tractor drawn Coast Artillery.

The training regulation on gunnery for fire against naval targets has been revised, and brought up to date together with the methods of fire control and position finding for fire on such targets. Antiaircraft gunnery is now being revised and will not be reissued to the service until after the results of the extensive firings now being held at Fort Tilden can be studied so that any new method developed during these firings may be introduced into the new text.

Ten (10) training regulations have been prepared during the year and printed and distributed to the service, making a total of thirty-four (34) Coast Artillery training regulations prepared and printed to date. Nine (9) training regulations have been prepared and are in the hands of the Adjutant General in process of being printed, and in addition, thirty-eight (38) authorized by the War Department are yet to be completed.

All Coast Artillery parts of the new Army Correspondence Courses are being prepared by the Department of Correspondence Courses at the Coast Artillery School in accordance with War Department instructions. These courses are being simplified, and presented in a much more interesting manner to the students. An effort has been made to clarify the method of instruction on artillery materiel by means of simplification in the explanation of its operation and by the use of numerous cuts of materiel which will be contained in a special regulation on Coast Artillery Materiel.

THE COAST ARTILLERY SCHOOL.—The outstanding features in this year's work at the Coast Artillery School have been the lengthening of the Advanced Course

from 5½ to 9 months with a consequent increase in efficiency, and the establishment of the Department of Correspondence Courses. The Department of Correspondence Course is now also charged, under orders from this office, with the preparation of the text of all Coast Artillery training regulations, and the Department of Military Art with the development of policies pertaining to the organization and tactical employment of the several classes of Coast Artillery units.

A Refresher Course for senior officers of the Coast Artillery Corps has been inaugurated and a few senior officers of the Corps assigned thereto, this course being the same as that designed for general officers, and normally lasting three (3) months.

If sufficient funds are available it will be the policy of this office to send, from time to time, senior officers of the Corps to take this course before such officers are ordered to assume command of regiments, this being done in order that they may be made familiar with the latest methods of Coast Artillery technique.

The following table shows the courses which were given in the Coast Artillery School during the past year, together with the number of officers in attendance and the number graduating:

Course	*Duration*	*Number of Officers Attending Course*	*Number of Officers Completing Course*
Advanced Course	9 months	36	34*
Advanced Engineering Course	4½ months	6	6
Battery Officers' Course	9 months	49	48†
Refresher Course for General and Field Officers	1-3 months	2	2
Special Course for National Guard and Reserve Officers	6 weeks for N. G. 8 weeks for O. R.	15 Nat'l Guard 8 Org. Res.	15 Nat'l Guard 8 Org. Res.

* Includes 1 Cuban Army Officer. † Includes 2 Cuban Army Officers.

The following courses for enlisted men were also given:

Course	*Duration*	*Number of Enlisted Men Attending Course*	*Number of Enlisted Men Completing Course*
Artillery Course	9 months	6	4
Engineering Course	9 months	25	22
Radio Course	9 months	13	9
Clerical Course	9 months	34	23
Special Diesel Engine Course	10 weeks	9	9

I again desire to renew my recommendation of last year relative to increasing the number of officers allowed to attend the Battery Officers' Course. It is earnestly desired that every officer of the Corps should be allowed the privilege of receiving instruction in the Battery Officers' Course before he reaches the grade of field officer.

Coast Artillery Organized Reserve Training.—The predominant features of the training of Organized Reserves during this year have been the training of units assigned to heavy tractor and railway artillery, the more intimate supervision over active and inactive training by unit executives, the increased interest

taken in the Army Correspondence Courses, the inauguration of periodical conferences on artillery subjects in certain centers containing a number of Coast Artillery officers, and the training of officers for wartime duty in this office and at the Coast Artillery School.

Up to this time it has not been possible to train properly in antiaircraft methods the personnel of the seventeen (17) antiaircraft artillery regiments located in the center of the United States, owing to the fact that no regular Coast Artillery antiaircraft regiment is available to form a training center for this class of work. Funds have been available to send only a few of the officers of these regiments to any of the three regular antiaircraft regiments located on the seacoast of the United States. Arrangements have been perfected to train this personnel, both National Guard and Organized Reserves, at Fort Sill, Oklahoma, and Camp Sparta, Wisconsin. To assist in this training, regular Coast Artillery teams will be sent from the nearest antiaircraft regiments located on the seacoast. This arrangement is not entirely satisfactory, and proper training can be given to these units of the Organized Reserves and the three National Guard regiments located in the center of the country only by organizing and stationing a regular antiaircraft regiment manned by Coast Artillery personnel of the regular army at some point located in the central part of the United States. Such action can be taken only by allowing an increase of 300 in the number of enlisted men assigned to the Coast Artillery Corps. An additional allowance of 20 Coast Artillery officers on duty with the branch will also be necessary.

A marked improvement in the number of Reserve officers taking Correspondence Courses has taken place during this year and at the present time 814 officers are taking one or more courses. This number is about 22½ percent of the number of Reserve officers of the Coast Artillery Corps.

Satisfactory training of the personnel of the Organized Reserves can be accomplished only by detailing one officer per each regiment or equivalent unit as unit executive with a mileage allowance which will permit him to come in contact with the officers of his regiment at least once each quarter.

Camps for Organized Reserves of all classes of Coast Artillery units were held during this year at nine regular Coast Artillery stations at which there was trained the personnel of 14 regiments which is about 20 per cent of the number of units now organized.

A more liberal allowance of target practice ammunition for the individual firing problems for the training of Reserve Officers should be allowed.

Reserve Officers Training Corps.—The academic year just completed at institutions where Coast Artillery R. O. T. C. units are installed is the first one under which these units have been trained pursuant to the new course of instruction. This course of instruction has proved to be the most satisfactory and tends to produce graduates well qualified to perform the duties of 2d Lieutenants in regiments whose mission it is to fire on naval or air targets.

The lack of a Coast Artillery unit in the Second Corps Area is becoming more acute every year. Fordham University has been chosen by this office for the installation of a Coast Artillery unit and the officials of that institution have petitioned the War Department for authority to establish such a unit. Favorable action has not been taken by the War Department owing to the nonavailability of funds for the purpose. It is urgently recommended that this unit be established at as early a date as possible and also that one additional unit be allotted to the Coast Artillery Corps to be established in the Second Corps Area.

Coast Artillery R. O. T. C. units are established as follows in the several Corps Areas together with number of students:

First Corps Area	2 units	582 students
Second Corps Area	0 units	0 students
Third Corps Area	2 units	948 students
Fourth Corps Area	4 units	1070 students
Fifth Corps Area	1 unit	439 students
Sixth Corps Area	2 units	437 students
Seventh Corps Area	4 units	1398 students
Eighth Corps Area	0 units	0 students
Ninth Corps Area	3 units	1059 students
Total	18 units	5913 students

259 graduates of the above institutions were commissioned this year as 2d Lieutenants, Coast Artillery Reserves.

The following R. O. T. C. Camps were held this year with the attendance as noted:

Fort H. G. Wright, New York	50
Fort Monroe, Virginia	254
Fort Barrancas, Florida	89
Fort Casey, Washington	41
Total	434

CITIZENS MILITARY TRAINING CAMPS.—Coast Artillery C. M. T. Camps were held during this year at six (6) different locations with an attendance of 1378.

The results obtained at these camps has shown a healthy improvement in so far as Coast Artillery training is concerned. However, there is grave doubt as to whether the graduates of the Blue Course, without further training, make efficient 2d Lieutenants of the Coast Artillery Corps. It is believed that these officers should be commissioned provisionally upon graduation from the Blue Course, and that they should not receive their final commission until they have attended at least one camp with the Reserve regiment to which they are assigned.

RECOMMENDATIONS FOR CHANGES IN ANNUAL WAR DEPARTMENT TRAINING DIRECTIVE.—I desire to recommend the following changes and additions to be embodied in the next issue of the War Department Training Directive in so far as the training of the personnel of the Coast Artillery Corps is concerned:

a. That the period to be devoted to the training of the civilian components of the Army by any regular Coast Artillery regiment be of not more than two (2) months duration in any training year.

b. That should conditions arise whereby Reserve regiments would receive their training at any other time than during the period mentioned in *a* at places where units of the regular Coast Artillery are stationed, the program of such Reserve training should conform as nearly as possible to that of the regular command. By this method it will be possible for the regular regiments to complete their training without undue interference by Reserve organizations.

c. That I, or my representative, be authorized each year to visit all stations at which regular Coast Artillery regiments are located in order to make the training inspection under A. R. 265-10 and to ascertain the condition of all Coast Artillery materiel located thereat.

d. That a representative of this office be authorized to visit each Coast Artillery Reserve Officers Training Corps unit once during the academic year.

e. That I, or my representative, be authorized to visit at least once each summer the Coast Artillery training camps located in each Corps Area with the exception of the Ninth.

f. That steps be taken to provide in each harbor defense, suitable artillery boat service for the towing of targets and for the simulating of the action of attacking war vessels for drill purposes. It is especially desired that a suitable boat be stationed in Hawaii for this exclusive purpose, which now is not the case.

Seacoast Artillery Firing

[COAST ARTILLERY BOARD PROJECT NO. 220]

EDITOR'S NOTE: *Coast Artillery Board Project No. 220 is one of the most important and most interesting projects ever undertaken by that Board. The* JOURNAL *regrets that the length of the project is such that it can not be given in full in these pages. However, the project, with omissions reduced to a minimum, has been secured from the Coast Artillery Board for publication in this and the two succeeding numbers of the* JOURNAL. *The action of the Chief of Coast Artillery on all parts of the project published herein will appear with the final installment.*

HISTORY OF THE PROJECT

1. During the past two years the Coast Artillery Board has submitted approximately 225 projects affecting the Coast Artillery service. Most of these projects have a direct bearing on Coast Artillery Doctrine and Fire Control methods, including preparation and adjustment of fire. The recommendations of the Coast Artillery Board contained in the various projects have been approved, in general, by the Chief of Coast Artillery. The projects have been prepared and forwarded at irregular intervals and their substance has been published to the service from month to month in the COAST ARTILLERY JOURNAL. Although submitted at irregular intervals and apparently without following any definite plan, the projects have actually been related. The objective of the Coast Artillery Board has been the development of sound doctrine and methods of fire control common to all calibers of fixed and mobile seacoast artillery. Moreover, the desirability of developing methods suitable for training of National Guard, Reserve and R. O. T. C. units has been given special consideration. At this time, the status of Coast Artillery Fire Control Materiel, Methods and Doctrine, is such that the Coast Artillery Board believes a review and coordination of numerous related Coast Artillery Board projects is desirable. In order to make such review and secure coordination, the Coast Artillery Board originated this project, *Seacoast Artillery Firing.*

DISCUSSION

2. A comprehensive study of Coast Artillery Firing involves consideration of the following subjects:

	Paragraph
Missions of Seacoast Artillery	3
Characteristics of Targets	4
The Time Element in Relation to Hitting	5
Classification of Seacoast Artillery	6
Antiaircraft Artillery as Seacoast Artillery	7
Effect of Fire	8
Development of Seacoast Artillery Fire Control Systems	9

Manual Plotting Board 10
Communications for Seacoast Artillery 11
Time Interval System 12
Position Finding 13
Concentration of Fire and Number of Cannon in a Battery 14
Prediction 15
Meteorological Data 16
Range Board, M 1905, and Range Correction Board, M 1923-E 17
Ballistic Range Correction 18
The Percentage Corrector 19
Range Adjustment Board 20
Deflection Board 21
Time Range (Elevation) and Time Azimuth Devices 22
Spotting Devices for Use in Terrestrial Spotting 23
Spotting Devices for Use in Aerial Spotting 24
Wind Component Indicator 25
Sights 26
Summary on Fire Control Developments and their Effect on Training and Supply 27
Preparation and Adjustment of Fire 28

3. *Missions of Seacoast Artillery.—a.* Official statements of the missions of seacoast artillery are given in War Plans Division Document No. 1, *A Positive System of Coast Defense,* and in paragraph 15, T. R. 10-5, *Doctrines, Principles and Methods, Basic.* Briefly these missions are:

(1) To prevent bombardment of important strategic points, such as large centers of population, important centers of manufacture and commerce, Navy Yards, coaling stations, docks, locks, and dams.

(2) To defeat a direct attack of hostile naval forces.

(3) To deny the enemy the entrance or occupation of harbors or other water areas which he might use as a base for land or naval operations, or both.

(4) To keep the enemy at such distance from the entrance to a water-way that friendly naval vessels may debouch therefrom and take up battle formation with the least hostile interference.

(5) To prevent the enemy from damaging or removing obstructions placed to deny him entrance to a water-way.

(6) To prevent the enemy from making a landing.

(7) To fire against suitable targets offered by enemy forces on land.

b. For the accomplishment of the above missions it is evident that seacoast artillery must be able to fire effectively against all enemy naval craft, including transports attempting to land troops, against personnel in small boats in the process of landing, against a landed enemy force, and against suitable targets in land warfare. Generally, the primary use for seacoast artillery is to deliver effective fire on moving naval targets. In fact, T. R. 10-5, *Doctrines, Principles and Methods,* assigns the Coast Artillery the independent role of keeping the area within reach of its guns clear of hostile vessels and of preventing a runby. The primary weapons for this purpose are the cannon and the submarine mine. The cannon must be of high power, mounted on a carriage of sufficient traverse to permit following a rapidly moving target, and it must be provided with a fire control system designed to furnish accurate firing data for moving targets. While the primary, as well as the most probable, role of seacoast artillery is to fire on naval targets, nevertheless seacoast artillery is assigned an auxiliary role in land defense of coastal areas, and also an auxiliary role in land warfare.

c. Seacoast artillery must be able to accomplish its missions in the following situations:

(1) Coast defense in which seacoast artillery may be operated from permanent or selected positions within the limits of permanent fortifications. This phase of coast defense is frequently referred to as harbor defense. Fixed seacoast artillery will use the standard fire control system of the forts. Mobile seacoast artillery may, in emergencies, use the standard or emergency position finding systems and communications of the forts, but as a rule it will establish a separate fire control system.

(2) Coast defense in which mobile seacoast artillery may be operated in areas contiguous to coast artillery forts under conditions necessitating a fire control system, together with communications, which is independent of those of the nearby forts, but may be interconnected with the systems of the forts.

(3) Coast defense in which mobile seacoast artillery, with its own fire control system, may be used to convert unfortified areas into temporarily fortified areas for the defense of open beaches and harbors against landings in force covered by hostile naval vessels.

(4) Coast defense in which mobile seacoast artillery, with its own fire control system, may be used in unfortified areas to defend coastal cities against harassing naval attacks.

(5) Landward defense of seacoast fortifications.

(6) Land operations with field armies when seacoast artillery can be used against targets suitable for the power of this class of artillery.

d. It is necessary to consider all the conditions under which seacoast artillery must operate in accomplishing its missions, since all the conditions have a direct bearing on a seacoast artillery fire control system, and on the preparation and adjustment of fire.

(1) The effectiveness of mobile seacoast artillery operating under the conditions [3*c* (6)] of land warfare requires little comment. Its accomplishments in the World War are generally appreciated. Moreover, it was then demonstrated that seacoast artillery units thoroughly trained for fire at moving naval targets could qualify quickly for effective fire in land warfare. For fire at naval targets, computing devices are essential. Seacoast artillery units are equipped with these devices, and trained in their use. These devices are applicable to land firing.

(2) The above comments also are applicable to the role of seacoast artillery [3*c* (5)] in landward defense of seacoast fortifications. There is no doubt of the potential effectiveness of properly trained and equipped seacoast artillery in the landward defense of seacoast fortifications. However, it is questionable whether Coast Artillerymen fully realize the necessity in time of peace for making those necessary preparations for landward defense that will insure the maximum effectiveness from seacoast artillery. The fire control equipment suitable for fire on naval targets is suitable for use in the landward defense of seacoast fortifications. Commanders in time of peace should obtain and record firing data for possible land targets, secure maps of adjacent areas, and perform necessary orientation work. Such preparations, some of which could not be made in the field, will insure advantages to the defense not to be expected in a war of movement. Assuming an adequate system of fire control for fire on naval targets, the war time effective-

ness of seacoast artillery in landward defense of coast fortifications will be measured by the foresight and initiative of Coast Artillery commanders in making comprehensive preparations in time of peace.

(3) In conjunction with the Air Service and the Navy, fixed and mobile seacoast artillery and the submarine mine should be quite sufficient to repel hostile naval attacks on permanent fortifications [3*c* (1) above]. Here we have shore guns and mines against guns on ships. Guns in temporary or permanent fortifications are practically invulnerable when compared to guns on ships. Naval authorities accept this condition as a fact, and history justifies the acceptance. * * *

(4) The foregoing discussion of the defense that fixed and mobile seacoast artillery provides for fortified harbors leads to consideration of the importance and effectiveness of *mobile* seacoast artillery in *all* coast defense operations. * * * Mobile seacoast artillery may be emplaced in fortified or unfortified areas. In either case it can be given substantially the effective fire control provided for fixed artillery. Mobile seacoast artillery may be emplaced in otherwise unfortified areas to protect beaches and harbors against the action of hostile naval vessels covering landings in force [3*c* (3) above], and to protect coastal cities from harassing naval attacks [3*c* (4) above]. Mobile seacoast artillery emplaced in permanent harbor defenses [3*c* (1) above], or in areas contiguous thereto [3*c* (2) above], supplements the permanently emplaced armament. It thereby increases the effectiveness of the permanent fortifications. When emplaced in an otherwise unfortified area, mobile seacoast artillery converts that area into a temporarily fortified area whose role is similar to that of a permanent seacoast fortification. Mobile seacoast artillery is as important in the defense from naval attack of temporarily fortified points as fixed and mobile seacoast artillery is in the defense of a permanently fortified harbor.

* * * * *

4. *Characteristics of Targets.* *a.* Since the primary mission of seacoast artillery is to destroy or drive away by its fire hostile naval vessels, it is pertinent, in a study of Coast Artillery firing, to discuss the characteristics of such naval targets. Naval vessels may be classified as capital and non-capital ships and submarines.

(1) Capital ships are those provided with high-power armament and heavy armor. They vary in length from 350 to 850 feet, and in width at beams from 70 to 100 feet. Maximum speeds vary from 18 to 35 knots per hour, that is, from 600 to 1200 yards per minute. Their armor is from 9 to 12 inches, and in a few cases as much as 14 inches, on the vertical surface protecting the vital parts of the ship. Their deck protection consists of from 2 to 7.5 inches of armor arranged in three or more decks, and in future ships this may be materially increased.

(2) The primary armament of the latest capital ships consists of from eight to twelve guns of calibers varying from 16 to 12 inches, and the secondary armament of from sixteen to twenty-four guns of calibers varying from 7 to 5.5 inches. All modern capital ships have special protection against torpedoes and mines and carry antiaircraft guns. The ranges of the primary armament are not in excess of 34,000 yards, and the maximum range of most secondary armament is approximately 15,000 yards. On a few ships second-

ary armament is mounted to fire at high elevations giving maximum ranges of approximately 18,500 yards.

(3) Non-capital ships are of the greatest variety The greater number of such ships have little or no armor, and, except for light cruisers and destroyers, have speeds of less than twenty-five knots per hour. Non-capital ships may be divided into armored and unarmored ships. Armored cruisers may have from six to nine inches of armor. The armored non-capital ships may have armament that includes 10-inch guns and a relatively large number of smaller guns, including antiaircraft guns. The recent Washington Treaty limiting the number of capital ships has led to the construction of a number of cruisers of about 10,000 tons with about three inches of armor, carrying about six 8-inch guns and having a speed of about thirty knots. Destroyers are usually unarmored and usually carry four 4-inch or 5-inch guns, also one or two antiaircraft guns. Their speed is thirty-five knots or greater. Some new light cruisers have 6-inch guns with about 18,500 yards maximum range, while the 10,000-ton cruisers, carrying 8-inch guns, will have maximum ranges of approximately 27,000 yards. Their speed is thirty-five knots or greater. The maximum range of 5- and 6-inch naval guns, regardless of their ship mountings at 44° elevation, is about 22,600 and 26,600 yards, respectively. However, the maximum range of guns mounted on most non-capital ships is limited, either by the type of gun or mount or by facilities for observation, to effective ranges of about 15,000 yards.

(4) Submarines of the latest types have a speed of approximately twenty knots per hour on the surface and of twelve knots per hour submerged. They are of large size and have a cruising radius of from 3000 to 5000 miles. They mount one or two guns as large as 6 inches in caliber. Greater size and speed, larger guns, and probably some armor protection are to be expected in future designs.

b. Naval craft may endeavor to destroy or silence the shore guns by gun fire. At the same time, the ships will strive to protect themselves by their speed and maneuvering ability, and by rendering observation and fire from shore guns difficult because of the smoke screens which the hostile ships or airplanes lay down. While a smoke screen interferes with and decreases the effectiveness of fire from seacoast guns, it generally will not completely interfere with such fire. The smoke screen also interferes with the firing of the ships. Usually the personnel on shore will be able to see parts of the ships protected by a smoke screen sufficiently well to permit range and position finding, though observation of impacts may be impossible. The leading elements of the agencies creating the smoke screen will be visible from shore and will be an inviting target for seacoast or antiaircraft guns within the limits of their range. If ships have sufficient visibility to justify firing, the shore guns also may be expected to have a visibility which will justify firing. In view of the effectiveness of fire from seacoast artillery and the vulnerability of ships, the shore guns should be able to maintain superior destructive fire. In any case the submarine mine is an effective means of the coast defenses for prohibiting a runby of hostile ships under cover of a smoke screen. It is believed that naval authorities realize that the greatest protection for ships exposed to attack of seacoast guns lies in the ships' mobility, that is, in their speed and maneuvering ability. In other words, it appears that the best protection for naval craft attacking coast defenses is to expose themselves to the fire of seacoast guns a minimum of time. Since maximum speeds

vary from 600 yards to 1200 yards per minute, it is evident that hostile ships may be expected to be exposed to fire but a few minutes at a time. For example, the 155-mm. G. P. F. has a traverse of sixty degrees, so that a destroyer traveling at thirty-five miles per hour at a range of 10,000 yards can cross the field of fire in ten minutes; at 5000 yards it can cross in five minutes.

5. *The Time Element in Relation to Hitting.* *a.* From the foregoing discussion it is quite evident that to accomplish its mission seacoast artillery must be able to open effective fire in a minimum of time and to secure a maximum of hits per period, that is, hits per gun per minute, during any short period the target may be exposed to fire. Time and accuracy are the elements which control in the case of effective fire on moving naval targets. The short time the moving target may be exposed to fire dictates that accuracy of fire be maintained with a minimum of reduction of the possible rate of fire.

b. Our Coast Defense Fire Control System makes possible the delivery of effective fire on ships, but to obtain this result battery commanders must use properly the tools with which they are provided. Coast Artillery fire control apparatus is acceptably accurate, but painstaking care is necessary in its operation. The ideal seacoast artillery fire control system should furnish accurate ballistic data to a cannon as rapidly as that cannon can be served, laid, and fired. Our present fire control system closely approximates this ideal, so that a high rate of fire should not decrease the accuracy of fire. However, in the practical application of the system the number of shots that will be fired in a given time will depend largely on the manner of conducting and regulating fire.

* * * * *

8. *Effect of Fire.* *a.* The naval engagements of the Russo-Japanese War indicated that it was not then necessary to explode shells in the vital parts of a ship to put the ship out of action. The racking effect due to the detonation of high explosive shells will probably open up the ship's seams, derange machinery, cause casualties to personnel and affect the morale to a considerable extent. The aim in our service is to explode projectiles in the vitals of a ship. Naval battles in the World War showed that a few such hits will damage ships sufficiently to drive them from action. In the battle of Jutland, capital ships withstood an average of twelve hits without being completely disabled. No empirical rules can be laid down as to the number of hits required to destroy or disable a ship. The number of hits assumed to give a reasonable probability of destruction can be but a rough approximation. In past studies, the Coast Artillery Board assumed five hits from primary armament to be required with projectiles of latest design to put a capital ship out of action or sink it. On the other hand, the Naval War College assumes from eleven to twenty hits with 14-inch projectiles as the number required to destroy or materially damage capital ships. Considering the power of our seacoast artillery primary armament and the design of projectiles in connection with the lessons of the naval engagements of the World War, it would appear that ten hits is a fair approximation to put a capital ship out of action or to sink it, and that one or two such hits *may* put any non-capital ship out of action. Guns of approximately 6-inch caliber will attack a variety of non-capital ships but, as a rough approximation, it may be assumed that to damage badly or to sink one of the destroyer class, six hits will be required, while for other suitable but larger targets twelve hits will be required.

b. The United States Navy has made a theoretical investigation of the subject of accuracy of fire. Mean range errors for each of the guns were computed and an average for all of them determined. With the theoretical mean range error thus determined, a fire control error on one half of one per cent of the range was assumed. Based upon these two errors the percentage of hits was then calculated assuming a target nine feet high joining a horizontal deck one hundred and two feet wide, this target representing very closely the above-water side-armor and protective deck of the latest design capital ship. No length of target was considered, since deflection errors were disregarded. The results are given below and are very nearly correct for any guns of the Navy primary armament.

Range in yards	*Percentage of hits*
12,000	19
15,000	15
20,000	10
25,000	7
30,000	5
40,000	3

No computations are given for ranges less than 12,000 yards, but it may be assumed that, from point blank range to 12,000 yards, the percentage of hits will vary from 100% to 19%, decreasing as the range increases. We may then assume:—

Range in yards	*Percentage of hits*
5,000	66
8,000	46
10,000	32

c. No computations of the Navy for percentage of hits to be expected from secondary armament on non-capital ships are available. Assuming the field probable error of the 155-mm. GPF and a target nine feet high joining a horizontal deck thirty feet wide, which target represents very closely the vertical and deck plates of a destroyer, and disregarding deflection errors, the percentage of hits to be expected is theoretically as follows:

Range in yards	*Percentage of hits*
3,000	60
5,000	25
10,000	8
15,000	3.7
17,000	2.7

d. The above approximations of expected hits for primary armament have been determined for Naval firings, which are necessarily conducted under less favorable conditions for accuracy in fire control than exist when firing seacoast artillery. If the determined percentages are approximately correct for the Navy, we can certainly expect a better percentage of hits from seacoast artillery. For example, experience with 12-inch mortars indicates an expectancy of 50% of hits, with a minimum of 25%, at all ranges. At best such calculations are only guides. The Navy figures are assumed correct for seacoast artillery in order to be conservative in the following estimates. Based upon the above tabulated expectancy of hits, it may be assumed that to destroy or disable a ship the following number of shots from seacoast armament will be necessary:—

Range in yards	*No. of 155-mm. GPF shots to destroy or disable a destroyer*	*No. of 14-inch shots to destroy or disable a capital ship*
3,000	10	
5,000	22	15
8,000		22
10,000	75	32
12,000		53
15,000	163	67
17,000	223	
20,000		100
25,000		143
30,000		200
40,000		334

e. The accuracy life of the type 14-inch seacoast gun is estimated at from 150 to 1000 rounds; the 16-inch gun from 100 to 750 rounds; the 155-mm. GPF as high as 3000 rounds. It is probable that the number of rounds per gun available at the outbreak of hostilities will be considerably less than the number corresponding to the accuracy life.

f. Estimated numbers of shots required to insure destruction of ships have been given to emphasize the tremendous expenditure of ammunition which must be expected in long-range firing, and also to emphasize the time required for destruction when the rate of fire of the guns is considered. The figures indicate that decisive battle ranges will be within 15,000 yards—ranges for which position finding based on terrestrial visual observation is most effective. Using the same expectancy of hits for naval vessels firing on shore targets, the above figures indicate the tremendous amount of ammunition which ships must expend before they can hope for any material damage to seacoast artillery, or to the utilities it protects. It is believed that under ordinary circumstances hostile ships will not be so prodigal with the limited amount of ammunition they have and so unmindful of the life of ships' guns as to expend much effort in long range bombardment. When they do so, shore defenses may ordinarily withhold fire with reasonable confidence and rest in comparative safety. The simulated bombardment of Fort Randolph and the Charges battery during the recent Panama maneuvers called for an expenditure of ammunition which certainly would not be made by a hostile Navy under service conditions. One of the conclusions from the firing of the Navy at the seacoast artillery emplacements at Fort Morgan was "that the probability of hitting a modern emplacement at 16,000 yards under the best conditions is not greater than 10%, and that only a small percentage of these shots which hit the emplacement will do any material damage." Every coast defense engagement in the World War confirms the high degree of invulnerability of seacoast artillery to naval attack. It should be possible for seacoast artillery to fire at ranges beyond those obtained by terrestrial position finding but such firing should be carried on in a most conservative manner, and main reliance for driving away or destroying hostile naval vessels operating at extremely long ranges should be placed in the Air Service. If aircraft gains position above a target, bombing can be conducted practically as satisfactorily at 40,000 yards from shore as at 10,000 yards. The effectiveness of aircraft bombing is sufficient to deny hostile navies unmolested bombardment of our fortifications, thereby permitting seacoast artillery, when the tactical situation permits, to reserve its fire for decisive battle ranges in which its chances for destruction are considerably superior to that of the aircraft bomb. At these ranges seacoast artillery

will give positive protection to the utilities in rear. For long ranges, that is, ranges beyond the limits of satisfactory terrestrial observation, seacoast artillery should be used in conjunction with the air service, and the firing conducted at extreme ranges, in the exceptional cases that the tactical situation demands it, by methods which will sometimes be independent of the terrestrial visual position finding system. This may be necessary at decisive battle ranges when visibility is poor or effective hostile smoke screens are laid down.

9. Development of Seacoast Artillery Fire Control System. *a.* The convictions of the Coast Artillery Board on matters of seacoast artillery fire control have been influenced by the principles involved in past development of the fire control system. Prior to 1901 there was no generally accepted system of fire control throughout the Coast Artillery service. Firing was at fixed targets. The range was determined by the ordinary long horizontal-base system, and ballistic range corrections were applied at the gun (not in the plotting room). In the Annual Instruction Order of 1899-1900 there was a clause which read in effect as follows. "When a company shall have become proficient in fire at fixed targets it may be permitted to fire at moving targets." Captain Erasmus M. Weaver, later Major General, Chief of Coast Artillery, was at that time in command of Battery G, 1st Artillery. He applied for permission to fire his annual battery target-practice ammunition at moving targets. Permission was granted and the firing took place. This practice developed that it was impossible to fire more frequently than once in three minutes because the method of fire control contemplated that the range of the target should be determined independently and separately for each round. That is, after the actual range determined specifically for each round was received from the plotting room, then the ballistic corrections necessary to apply to the actual range were computed at the gun before the gun could be set for range. As a result, it was found that the gun was loaded and ready to fire before the ballistically corrected range was available for the range setter. He had to wait from two to three minutes before the computed range could be set on the gun. It was considered essential to prevent this loss of time so that steps were taken to develop a system of fire control which would enable the range setter always to have the corrected range available when the gun was loaded. The principle laid down was that "a loaded gun should not be held up an instant for lack of corrected range for setting the range scale." The Coast Artillery Board subscribes to this same principle today. It will be shown that the present-day fire control system, properly used, applies this principle. However, in the present-day conduct of fire the principle is quite generally violated by delaying the fire of a loaded gun for the application of a range correction based upon a round-to-round deliberate adjustment of fire. The Coast Artillery Board believes the present-day violation of this basic principle, caused by the manner of regulating fire, is as fallacious as was the violation when it was due to the failure to have ballistic data at all times available for a loaded gun. Furthermore, it is believed that the present-day violation can and should be eliminated by means which will hereinafter be indicated.

b. Beginning about 1901 Coast Artillery officers concentrated their efforts on the development of a fire control system which would make corrected ranges always available at the guns. In 1902 and 1903, a Board of Officers consisting of Colonel J. P. Story, Major J. A. Lundeen, Major Garland Whistler, Captain Erasmus N. Weaver, and Captain G. T. Bartlett, was assembled to prepare a uniform system of drill regulations. After a long and careful study of the sub-

ject, the Board submitted a provisional set of drill regulations in 1906. The basic features were:

(1) Having the range and deflection corrections made immediately in connection with the plotting-room work.

(2) Firing at a predicted point and sending the corrected range of a set-forward point from the plotting room to the guns, thus accomplishing the object of having the corrected range always available for the range setter.

The 1906 drill regulations were superceded by those of 1909 which continued the system of predicted firing and contained rather complete instructions in regard to fire control. The plotting board was used for plotting the course of the target at 15-second observing intervals. Predictions were made on a range correction board, the ballistic correction determined on the range board was applied to the gun arm of the plotting board, and a corrected range was determined on the plotting board. A time-range relation was provided for, but there appears to have been a more or less general failure to appreciate the importance of this time-range relation in a system of fire based upon the sound principle that a loaded gun, at all times, should have corrected ranges available. The method of predictions increased inaccuracy and the time-range board or similar device for determining the time-range relation drifted generally into disuse. Up to this time firing was at comparatively short ranges, and while there was some attention given to correction of fire (for range) from observation, the results were not too encouraging. The system of range spotting similar to that used by the Navy proved unreliable, little attention was given to corrections based upon the instrumental observation, and consequently main reliance was placed on ballistic firing. Corrections for range based upon observation of fire were not, at this time, prohibited, but they were not generally made. Deflection corrections for both guns and mortars based upon instrumental observation were generally made.

c. In 1912, when General Weaver became Chief of Coast Artillery, the 1909 regulations were in force. With a view to improving the 1909 fire control methods, certain changes were ordered from which resulted the 1914 drill regulations. These regulations provided for a 30-second observing interval instead of a 15-second observing interval. The 1909 regulation in reference to the time-range relation was rigidly enforced and the time-range board at the emplacement prescribed for use. Predictions were made on the plotting board, a corrected range being obtained from the range correction board. The method of fire contemplated trial shots and application of resulting corrections as muzzle velocity corrections, after which (except in the case of mortar fire) no corrections were permitted to be made from observation of impacts. The 1914 drill regulations were much criticized because correction of fire was prohibited, because of the time-range board, the 30-second observing interval, and the fact that predictions were made on the plotting board. As a result, in 1915, a Board of Officers was appointed to meet at Fort Totten, N. Y., to study the 1914 system and recommend changes if found necessary. Previous to the meeting of the Board the keeping of the time-range relation in the plotting room was authorized. The following conclusions of the Fort Totten Board are quoted:

(1) The Board is of the opinion that the present system of fire control described in Drill Regulations for Coast Artillery, 1914, as amended by Changes No. 1, and amended as recommended below, will insure efficient fire control instruction of Coast Artillery troops, that is, it is sound

in principle, and that it should be adhered to in principle until by actual test a better system is shown to exist.

The Board considers that in many places the present fire control installations are extremely vulnerable to an enemy's attack, and that immediate steps should be taken to provide a remedy. It further believes that plotting rooms should be placed in protected positions, perferably at the battery, and that multiple base lines should be provided as soon as a plotting board can be devised which will admit of ready change from one to another.

(2) The Board is of the opinion that the following paragraph, in substance, should be added to the Drill Regulations for Coast Artillery, 1914:

"Whenever during the firing of seacoast guns and mortars, instrumental observation from shore stations or from air or water craft shows that the use of ballistic methods has failed to place the center of impact near the target, adjustment of fire based on such instrumental observations is authorized."

(3) The Board is further of the opinion that the following sentence, in substance, should be added to Paragraph 80, Drill Regulations for Coast Artillery, 1914:

"When a target is first assigned, additional observations may be taken between bells, in order to reduce to a minimum the time necessary to furnish data to the emplacements for opening fire."

In making the foregoing recommendations the Board is actuated by the belief that by lessening the observing interval, a certain part of the time now lost in changing targets may be saved. There are, however, other elements at work to cause loss of time, which elements are believed to be common to both the system and the 1914 system. It will require an actual trial to determine how important a part of the total loss can be saved by the change proposed.

The recommendation as to adjustment or fire based upon instrumental observation was approved. However, the methods of using the data so determined remained generally crude, and they are not yet above criticism in their application to moving target firing.

d. From 1915 until after the War, Coast Artillery fire control was changed but little. Meantime, the range and power of guns greatly increased, aerial observation became an accomplished fact, and methods of measuring atmospheric conditions aloft made possible more accurate determination of ballistic firing data, with the possibility of applying to mortars the methods of ballistic fire previously possible only with guns. The World War in which so many Coast Artillery officers had considerable experience in land warfare, influenced them to neglect their ballistics in seacoast artillery firing and to apply Field Artillery methods of adjustment to the more difficult problem of fire at moving targets in water areas. Extremely long-range firing and an unwarranted desire for concentration of fire influenced all projected Coast Artillery fire control development so that up to 1922 it appeared that some Coast Artillery officers conceived that the fundamentals of the 1915 system of fire control should be discarded. About the only development of the 1915 system was the 110-degree plotting board, which makes possible some interchangeability of base lines when orientation data is known at the time of construction of the plotting boards.

e. During the post-war period, too much attention was given to adjustment of fire by observation, and too little attention to ballistic preparation of fire. The Coast Artillery Board believed that the main role of seacoast artillery still was within the limits of terrestrial observation and that a fire control system based thereon was sound. The assignment to the Coast Artillery of high-power mobile artillery, both railway and tractor, necessitated a fire control system suitable for mobile seacoast artillery. None had been developed and the ideas of most officers assigned to mobile coast artillery units seemed to be based on an understanding that the primary mission of such mobile units was fire on fixed land targets in land warfare. In 1922, the ideas of the Coast Artillery Board perhaps were reactionary as compared to prevailing Coast Artillery opinion. The basic principles which have guided the Coast Artillery Board in recent fire control development are therefore summarized as follows.

(1) The primary mission of all seacoast artillery units is destruction of naval targets.

(2) Seacoast artillery is practically invulnerable to attack by naval craft.

(3) The main role of seacoast artillery will be accomplished within the limits of terrestrial observation, that is, at ranges less than 25,000 yards.

(4) Decisive battle ranges are within 15,000 yards.

(5) The best protection ships have against shore guns is to expose themselves to fire a minimum time.

(6) Hits per gun per minute during any short period the target is exposed to fire is the object of all seacoast artillery, and therefore this object should be emphasized in instruction and training.

(7) Ballistically prepared firing data is essential and should be accurate enough to rely upon when adjustment of fire through observation of impacts is not possible.

(8) Ballistically prepared firing data will not always place the center of impact on a target and keep it there, so that means for adjustment of fire based upon instrumental observation, including aerial observation, should be provided.

(9) When a tactical situation demands the fire of a gun, the fire of that gun should not be held up an instant for lack of data, whether due to ballistic computation or because of application of corrections based upon observation of previous shots.

(10) The tactical principles involved may call for fire varying from concentrated fire on a single target to fire directed on several targets. The position finding and fire control system should permit distribution of fire sufficient to meet any probable tactical situation but should not hinder concentration when advisable. * * *

(11) Each battery normally should have position finding installation for its usual field of fire and fire control equipment. The system should be such as to permit furnishing position finding or firing data to the batteries and to utilize position finding or firing data received from other batteries or position finding data received from a central station (Group or Battalion).

(12) Each fort and group of fixed seacoast artillery and each battalion of mobile seacoast artillery should have position finding equipment.

The fort and regimental position finding equipment is primarily for the purpose of furnishing basic data in emergencies to battery units.

(13) Since the peace time mission of regular Coast Artillery is largely one of training National Guard, Reserve and R. O. T. C. units, the system of fire control should be such that the fundamentals thereof are suitable for training such units at their home stations in the application of principles and in the use of devices to be encountered in service.

(14) So far as possible the fire control system should be applicable to all classes of seacoast artillery guns and mortars, both fixed and mobile, thereby making for uniformity of devices, methods of fire control, and training.

(15) So far as may be practicable, any system of fire control adopted for short and medium-range firing should be based on principles which can be applied to long-range firing.

(16) The fundamentals of the seacoast artillery fire control system should be applicable to fixed target firing so that officers and units will be prepared and equipped to perform their secondary missions of fire at fixed targets in land warfare.

f. Having in mind the above basic principles, the Coast Artillery Board believed that the 1915 fire control system was suitable as a basis for developing a system of fire control applicable to post-war conditions. Therefore, the Coast Artillery Board considered very carefully the recommendations of the Board of Officers appointed in 1915, given in paragraph 9 *c* above.

10. *Manual Plotting Board. a.* The 1915 Fire Control Board recommended that "multiple base lines be provided as soon as the plotting board can be devised which will admit of ready change from one base line to another." A plotting board which would admit of ready change from one base line to another was essential for mobile seacoast artillery. Neither the Whistler-Hearn nor the 110-degree board have the necessary flexibility. In Coast Artillery Board Project No. 74, the Cloke Plotting and Relocating Board was recommended for adoption. It permits ready change from one base line to another. The Universal platen of the Cloke Board gives all the flexibility necessary for either fixed or mobile artillery. In addition to the universal platen, a specially prepared platen may be used in connection with fixed artillery which is a means of obtaining, without the necessity of reorientation, the flexibility necessary to utilize all available base-end stations. One of these boards made from a Whistler-Hearn plotting board has been given a thorough service test at Fort Monroe. It proved very satisfactory. It is simple to operate, has but two arms, primary and secondary, and has a single continuous azimuth circle. The confusion and interference caused by arms, couplers, reading windows, and azimuth circles on the 110-degree and Whistler-Hearn Boards is eliminated. Besides possessing the necessary flexibility for use with either fixed or mobile seacoast artillery it posseses the accuracy and speed necessary to obtain firing data. It may be used as a relocating board. This board permits any battery to make use of data fur-

nished by any base line which can make observations and transmit readings. The Cloke Plotting Board is suitable for both fixed and mobile seacoast artillery. These boards are now being issued to the service.

b. The Coast Artillery Board believes that the manual plotting board in connection with terrestrial observing stations is an acceptable device for the solution of the position finding problem for seacoast artillery within the maximum limits of visibility from shore stations; furthermore, that such a system gives the necessary grounding in fundamentals of fire control for all seacoast artillery firing. The Coast Artillery Board believes that National Guard, Reserve and R. O. T. C. training should be based primarily on fire control methods using terrestrial observation and manual plotting boards.

c. Assuming flexibility of communications, the position finding system at fixed batteries could be improved by issue of Cloke Plotting and Relocating Boards in place of the types of plotting boards now being used. Nevertheless, the Coast Artillery Board realizes, that the expense involved will probably limit the installation of Cloke Boards at fixed batteries to replacement purposes and to new armament.

d. It may be that a satisfactory substitute for the manual plotting board will ultimately be developed. The coincidence target computer is still under development and may give an acceptable solution of the range triangle. The coincidence target computer reported on in Coast Artillery Board Project Nos. 8 and 9 was objectionably slow. The instrument is now in the hands of the Ordnance Department and investigation is being made with a view to improving it. It should be noted that any computing device which eliminates the plotting board will thereby eliminate the graph of the target's course, which graph, as pointed out in paragraph 15, Prediction, is most valuable in moving target firing.

11. *Communications for Seacoast Artillery. a.* The Cloke Plotting and Relocating Board furnishes a means for ready change from one base line to another provided multiple base lines are available and the communication system permits their use. With our present fixed seacoast artillery fire control installations, the first step in taking advantage of the flexible plotting board must be taken at the fire control switchboard. The general system of having many primary and secondary observing stations grouped on the same cable is an evident weakness in fire control installations, but the practice is justified on the grounds of economy and the probability that this cable will be supplemented by others when war is imminent. No satisfactory means is provided in the present standard communication system whereby reassignment of base end stations can be made to meet the conditions in action, when it is probable that permanent installations will be injured by hostile fire. To insure that a continuous plot of a vessel's track can be made and fire efficiently maintained, it is necessary to make provisions for obtaining data from base-end stations which remain in service and are observing on the same target and for utilizing such data by a battery or plotting room which is crippled by the unserviceability of its assigned observing stations. It has been demonstrated that the communication system now used at fixed batteries can be utilized to give the flexibility desired. The

following quotation of the Commanding Officer, Coast Defenses of Puget Sound, is pertinent:

> Major Louis B. Bender, Signal Corps, who is now a member of the Coast Artillery Board, was Coast Defense Engineer here in 1916-1917, He recommended a modification of existing fire control switchboards which consisted of adding two panels to each, using commercial telephone material which could be bought locally. At the time he estimated the coast of this modification at $500 per fort, and claimed that this modification would give such flexibility to the communications that full advantage could be taken of the flexibility of the Cloke Board and any combination of stations thrown in on any battery or plotting room.

b. That flexibility of communications can be obtained is evident. The target practice report of Battery Worth at Fort Casey for the year 1919 shows that base-end stations were interchanged at will without reorientation of the plotting board, and that a continuous plot of the target's track was maintained during the practice. A Cloke plotting board was used. Flexibility of communications was obtained by means of a temporary modification of the switchboard panels.

c. Fire control switchboards installed prior to 1910 made possible the interchange of base lines within the fire command. However, after extensive use of the so-called distributing switchboard (type in use prior to 1910), it was decided that the advantages to be gained by being able to transpose lines of communication of various base lines did not compensate for the complication and ex pense involved. The distributing switchboard was superceded therefore by a switchboard which does not provide a ready means for interchange of base lines.

d. In at least one particular installation since 1910, to wit, the mortar fire command at Fort Mills, P. I., provision has been made for an immediate transposition from one base line to another. Such installations, however, are not general. In those cases where use is made of them they are designed to meet the peculiar needs of a particular situation. In view of the availability of the Cloke Plotting Board it is believed that the principle of flexibility in communications should not be limited to the fire command but should be extended to the entire fort command communication system. Furthermore, in the event of an attack on any of our fixed batteries, it may be expected that mobile artillery will be called upon to supplement the fixed armament. * * *

e. In an effort to secure the maximum flexibility in a communication sustem, the Coast Artillery Board submitted Coast Artillery Board Project No. 111, *Fire Control Telephone systems for Fixed and Mobile Artillery.* The following is a summation of the Coast Artillery Boards' conclusions:

> (1) The following commanders should be provided with base lines and communications pertaining thereto under their respective separate tactical and physical control:
>
> *(a)* Each battery commander,
>
> *(b)* Each group or battalion commander.
>
> (2) The communication system should permit any two suitable observing stations within a fort being used as a base line.

(3) Provisions should be made so that any battery can obtain data from any base line, within the fort that covers its field of fire.

(4) When acting independently, mobile seacoast artillery will establish forts, groups, and batteries corresponding in organization to those of the fixed batteries. When acting in conjunction with the fixed batteries they will usually establish only groups and batteries and rarely forts. Their communication system conforms tactically to that of the fixed batteries.

(5) The present coast artillery communication system does not meet the needs of the fixed and mobile coast artillery as outlined above and is below commercial standards in the matter of communication efficiency, thus rendering it unsuitable for long-range armament.

(6) The present installations should be revised to conform, as far as practicable, with the conditions of service outlined above, and should be replaced by efficient modern equipment when and where this is financially practicable.

f. The Coast Artillery Board recommended that the Signal Corps be called upon to design and submit for test the essential elements of one or more sample fire control systems meeting the conditions set forth in the above resumé. In acting upon this recommendation the Chief of Coast Artillery arranged a conference between members of his office, the Chief Signal Officer's office, and the Coast Artillery Board. At this conference the following principles were agreed upon as a guide to future action:

(1) No effort should be made to improve fire control communication systems now installed as far as short-range armament is concerned.

(2) All new 16-inch armament and other long-range batteries should be provided with up-to-date fire control communication systems.

(3) An ideal fire control communication system for long-range batteries should be developed and, if possible, installed for test with a view to approval as a general type for future installations.

(4) The fire control communication system required in each specific case should be determined by a Signal Corps study, made after the locations of guns and stations had been determined by the Coast Artillery, and should conform in principle to the approved type.

g. The above discussion in reference to communications, as well as Coast Artillery Board Project No. 111, was concerned principally with fixed battery installations but contemplates the application of the same principles to mobile seacoast artillery units. Therefore, the Coast Artillery Board has prepared Coast Artillery Board Project No. 242, *Communication System for Mobile Seacoast Artillery.* It provides for interchangeability of base lines between two adjacent batteries and with the battalion base line. There appears to be no difficulty in putting this system into effect with mobile batteries since the equipment recommended is an elaboration of that at present prescribed in Tables of Basic Allowances. A study of C. A. B. Project No. 75, *Fire Control System for 155-mm. G. P. F. Guns,* in connection with Projects Nos. 200 and 242, will give a complete outline of the proposed fire control system for 155-mm. G. P. F. batteries.

12. *Time Interval System. a.* In connection with the development of communications for seacoast artillery, the Coast Artillery Board has devoted con-

siderable study to the Time Interval System. The time interval system is essential to a system of fire control based on terrestrial observation from two widely separated stations. The time interval apparatus must be sturdy, reliable, reasonably accurate, and suitable for transportation with mobile artillery.

b. The present standard time interval bell system is generally satisfactory at present fixed batteries, where lines are comparatively short and of low resistance. The limit of operation of one bell over one line appears to be five miles. On shorter lines two or more bells may be operated in parallel. For longer distances two or more lines per T. I. bell must be used. Owing to the great increase in range of post-war seacoast artillery, communication lines, phone to phone, will frequently be fifteen to twenty miles in length, and in some exceptional cases they may be thirty miles long. Ninety per cent of the lines will be less than six miles long from telephone to telephone. Time interval signal lines will be of corresponding length.

* * * * *

d. The 30-second observing interval is now standard for Coast Artillery. When tracking is begun and especially when targets are changed, observations oftener than each thirty seconds are frequently desirable, are practicable, and may be made at least until the graph of the target's course is sufficient to permit plotting-board predictions. Other circumstances may make desirable observations more frequently than each thirty seconds, and such observations should be permitted. The predicting interval may be thirty seconds or a multiple thereof. Such predicting intervals provide for a regular flow of data, and even though all classes of cannon may not be capable of being fired as often as the prediction is made, the plotter is enabled to form a more accurate track of the target than with a larger observing interval and to have at hand fairly fresh data as to the target's position. Plotting-board predictions made more frequently than each thirty seconds are, in general, impracticable.—*(To be Continued)*

Spark Photograph of a .30-Caliber Tracer Bullet

By PHILIP P. QUAYLE, *Bureau of Standards*

The projectile photographs presented herewith were obtained by the method described by the writer in the *Journal of the Franklin Institute* of May, 1922. The important characteristics of the method are that the bullet motion is in no way influenced by the photographing operation nor does any mechanism involved in this operation appear on the plate. Since the earlier publication the apparatus has been completely redesigned and reconstructed so that its performance is more consistent and less dependent upon weather conditions (leakage) and that greater definition is obtained.

Fig. 1 is a photograph of a tracer bullet. It appears to have been generally believed that the strong light which the tracer bullet itself emits would prevent its successful photography. Visual observation tended to confirm this belief. The successful photograph was obtained by using a rectangular tube of black paper with its axis transverse to the trajectory and coincident with the line joining the spark gap and the center of the photographic plate. By this device the plate was shielded against the tracer light before and after the bullet had tra-

versed the tube. The plate is fogged of course, but it nevertheless shows some interesting details.

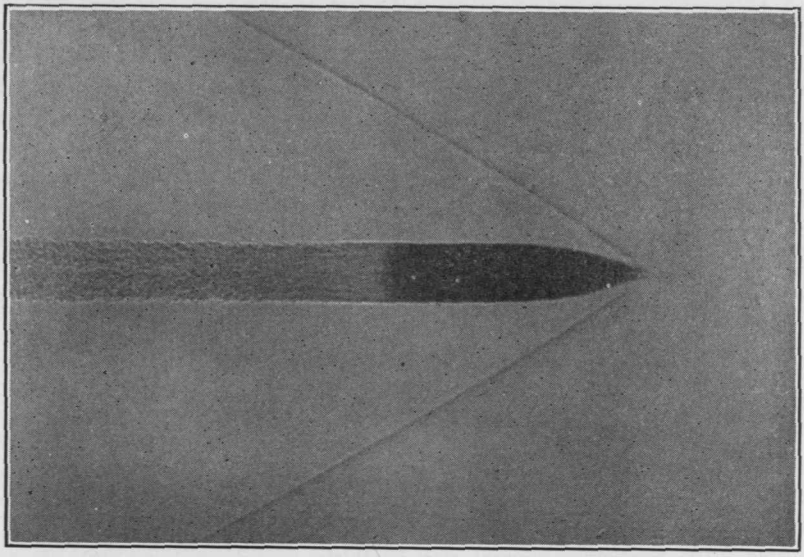

FIG. 1

The most striking thing is the almost complete absence of a tail wave (see Fig. 2). The usual tail wave is undoubtedly associated with the rapid pressure

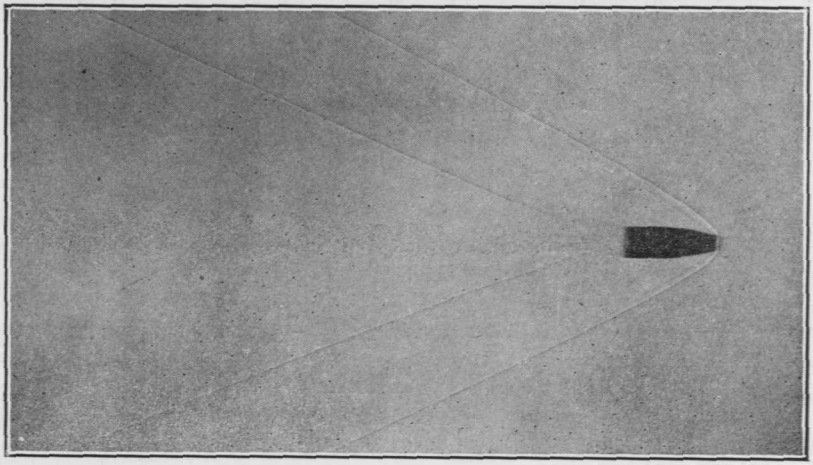

FIG. 2

change at the base which accompanies the partial vacuum behind it. Apparently the gases generated by the tracing compound prevent the formation of a region of diminished pressure, and hence the formation of a tail wave.

The second feature is the white axial line which apparently splits the nose of the bullet. This characteristic is common to all photographs which have been made with the new apparatus. Exhaustive experiments indicated that it is not due to any characteristics of the spark. To get further information on this point a portion of the nose was machined off several projectiles.

The photographs of these modified projectiles indicated that the line which apparently splits the nose of the bullet is really the apex of a very sharp wedge of light which is bent around the nose of the bullet presumably by the bow wave and falls upon the plate in the region of the bullet's shadow.

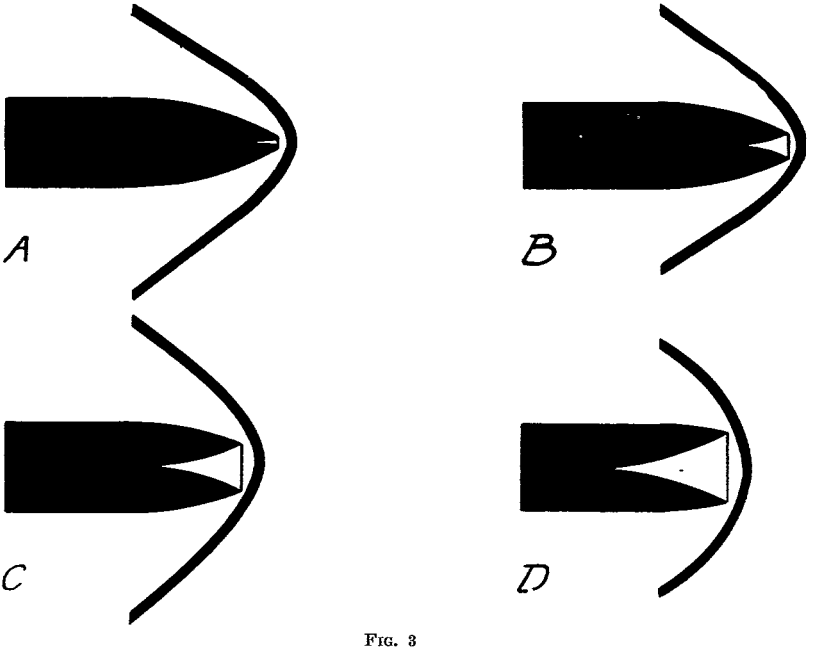

FIG. 3

Drawing indicating the progressive stages in the development of the wedge-shaped figure which occurs at the point of the projectile. "A," normal .30-caliber service bullet; "B," "C" and "D," modified forms of the service bullet. Scales: twice actual size.

The shape of this wedge varies with the curvature of the bow wave which in turn changes with the degree of bluntness of the projectile, as indicated in Fig. 3.

The mass of compressed air which a projectile pushes ahead of its nose undoubtedly contributes to the modification of the effect observed on the more pointed type of projectiles.

About two inches back from the base of the tracer bullet, particles of the tracing compound can be seen as they leave the wake.

Reserves at Fort Winfield Scott

Military activity at Ft. Winfield Scott, Calif., has been considerably enlivened recently by the presence of a number of Coast Artillery officers from the Organized Reserves, who are spending their annual 15 days of active duty at that post. The officers in attendance include those of the 627th Coast Artillery Regiment,

the 1st Battalion of the 628th, and Battery A of the 625th. The 627th is a San Francisco regiment, the 628th from Oregon and the 625th from San Diego. The Reserves have been instructed in the study of the problems incidental to the mobilization of Reserve units in the event of war as well as in a study of the various methods of fire control and fire adjustment as used in harbor defense. —*Army and Navy Journal.*

Artillery Ordnance Development

EDITOR'S NOTE: *The following notes were compiled in the office of the Chief of Coast Artillery by Captain Aaron Bradshaw, C. A. C. Credit is accorded the monthly Digest of Activities of the Ordnance Department for much of the information contained herein.*

POST-WAR DEVELOPMENT OF PROPELLANT POWDERS.—The experience gained during the World War emphasized the desirability of certain improvements in the present approved service smokeless powder for both cannon and small arms. The present service propellant for all cannon for caliber .30 rifles is so-called "pyro" powder, consisting of an ether-alcohol colloid of pyronitrocellulose in the form of relatively short cylindrical grains provided with one or more longitudinal perforations. Practically all cannon powders have seven perforations, while the caliber .30 powder is in the form of mono-perforated grains. A small amount of a stabilizer is incorporated in the colloid for the purpose of retarding the gradual decomposition, which is an inherent property of nitrocellulose and similar organic nitrates, particularly when exposed to unfavorable conditions of storage as regards heat and moisture.

Powder of this type, properly manufactured and stored under reasonable conditions in tightly sealed containers has proven highly satisfactory in many respects. There exist in the service at the present time powders manufactured over 20 years ago, prior to the adoption of a stabilizer, which are still in good condition as regards both stability and ballistics. The relatively low temperature of combustion of pyrocellulose powders reduces the erosive effect on the ggun barrels to a minimum, and the practically complete absence of smoke is a marked advantage.

The main disadvantages of pyrocellulose powders are the brilliant muzzle flash which they produce when fired, and their tendency to absorb moisture when not hermetically sealed from contact with the atmosphere. The tactical advantages which would result from elimination of the muzzle flash are apparent. Absorption of moisture by assembled charges in storage cases or in fixed ammunition causes a falling off in the velocity which the charge will produce, and in the case of bulk powder which has absorbed moisture, reblending and re-establishment of charge is necessary. Pyrocellulose service powders all contain an appreciable amount of residual solvent (ether and alcohol) which is necessarily left in the grains in the drying process during manufacture. Exposure to the atmosphere during storage of either assembled charges or bulk powder causes a gradual loss of part of this residual volatile solvent, with a consequent increase in velocity and pressure produced by a given weight of charge. Loss of solvent probably tends to leave the grains more porous, thereby increasing their tendency to absorb moisture. Both of these factors, i. e., the loss of solvent and the absorption of moisture, tend to accelerate decomposition of the nitrocellulose and thereby shorten the storage life of the powder; hence it is important that powder of this type be kept in hermetically sealed containers.

In view of these facts, the ideal propellant powders should be not only smokeless. but flashless and nonhygroscopic, and contain a minimum proportion of volatile residual solvent, or preferably a non-volatile solvent.

Attempts to produce flashless powders were made at Picatinny Arsenal several years prior to 1914, and the work was energetically pursued during 1917 and 1918. In 1919, however, a definite problem for the development of a flashless, non-hygroscopic, smokeless powder was formulated, based on the recommendations of the Westervelt Board as a result of experience gained during the war. Since that time efforts have been concentrated on obtaining powder which will combine the properties of smokelessness, flashlessness and non-hygroscopicity, together with the other essential characteristics which are required of an approved propellant, such as stability, facility of manufacture, availability of raw materials, minimum erosiveness, etc.

Muzzle flash is produced by the rapid combustion, or rather explosion, of the large volumes of combustible powder gases,—carbon monoxide, hydrogen and methane,—as they become mixed with the oxygen of the air on issuing from the muzzle of the gun, forming an explosive mixture. Their explosion may be spontaneous, due to the fact that, in spite of their sudden expansion, they are still heated above their ignition temperature, or it may be due to ignition by burning fragments of powder grains or incandescent solid particles ejected from the gun. In order to produce flashlessness it is therefore obvious that the temperature of the inflammable gas mixture be reduced below the point at which it will ignite when mixed with the air at the muzzle, and that the granulation of the powder be such that the charge is completely consumed before the projectile leaves the muzzle.

In addition to the development work which has been carried on at Picatinny Arsenal, a very large amount of similar work has been carried on by the du Pont Company, in cooperation with the Ordnance Department, on both cannon and small arms powders, and by the Hercules Powder Company on small arms powders.

75-mm. Powders.—A large proportion of the work which has been done on FNH (flashless, non-hygroscopic) smokeless powders has been confined to the 75-mm. gun for reasons of economy and convenience, it being obvious that fundamental data as to the effect of various ingredients on flash, hygroscopicity, smoke and ballistics obtained in tests with this gun would be applicable in the study of powders for other guns. Several experimental lots of powders have been manufactured for the 75-mm. Gun, Model 1897, which differed widely in both composition and form of grain, and all of which are regarded as satisfactory for this gun. Two of these have been subjected to actual service tests involving the firing of several thousand rounds. These experimental powders are being subjected to a program of periodic tests to obtain data as to their ballistic and chemical stability, and none have been found to have undergone material alteration during several years of storage. The flash produced is reduced to a dull red glow which gives no illumination of surrounding objects; the smoke is practically negligible; the hygroscopicity is no greater than that of powders with high nitroglycerin content such as Cordite; and the required service ballistics are obtained with charges which in most cases do not materially exceed the service charge of pyro-powder. It is of interest to note that the noise produced by the discharge of the gun is materially decreased when the muzzle flash is eliminated. This is to be expected, since a large part of this noise is due to the explosion of the gases which produces

the flash. It is considered that the problem of an FNH powder for the 75-mm. gun, Model 1897, has been satisfactorily solved, although there is good reason to believe that further development will lead to greater improvements.

Considerable progress has been made toward a satisfactory powder for the 75-mm. gun, Model 1920, although the much larger powder charge necessary for obtaining the higher velocity prescribed for this gun greatly increases the difficulty of eliminating the flash.

155-mm. Howitzer.—Two experimental lots of FNH powder for the 155-mm. howitzer, of widely differing composition and of different form of grain, have been manufactured, which are quite satisfactory except for the fact that they are not consistently flashless with the inner zone charges. This difficulty is to be expected, since the powder burns much more slowly under the influence of the greatly reduced pressures obtained with the reduced charges. It is believed that considerable improvements can, however, be obtained in this respect. These experimental lots are being subjected to service tests.

105-mm. Howitzr.—An entirely satisfactory FNH powder has been developed for the 105-mm. howitzer and an experimental lot manufactured for service test. This powder is of the same composition as one of the powders which has given excellent results in the 75-mm. gun.

3-inch A. A. Guns.—Preliminary results obtained with FNH powder granulated for these guns are quite promising and it is expected that satisfactory powders for this caliber will be produced during the coming year. The 3-in. A. A. gun presents a problem similar to that encountered in the 75-mm. gun, Model 1920, the high velocity, and consequent large powder charge required, increasing the difficulty of eliminating the flash.

155-mm. Gun.—Very promising results have also been obtained in this gun and greater progress is expected during the coming year. An improved powder, which although not flashless is non-hygroscopic and smokeless, has been manufactured in appreciable quantity for issue to the service. It is believed that this powder will be found to possess greater chemical and ballistic stability than pyro-powder.

Small Arms.—The work on development of FNH powders for caliber .30 and caliber .50 weapons has not as yet led to as gratifying results as have been obtained on cannon powders, but is being energetically pursued by both the Ordnance Department and private manufacturers.

3-INCH A. A. GUN MOUNTS.—The Technical Staff approved on May 21 the modification of all 3-in. A. A. Gun Mounts, Model 1917, now in service. The modifications are intended to render the mounts more easily loaded and operated. Owing to the slight difference in the design of side frames of the present mounts, the modified mounts will be differently modified. They will be known as 3-in. A. A. Gun Mounts, Model 1917 MII and MIII. The 1917 MI mount, while formerly considered a modification of the existing 1917 model, is in reality a new design.

BORE SCRAPING DEVICE.—A bore scraping device for removing copper from the bores of 3-in. A. A. guns has been developed at the Aberdeen Proving Ground. A number of these have been ordered manufactured. They will be sent to the service for test.

RAILWAY AND SEACOAST ARTILLERY.—The 75-mm. Subcaliber Gun on 12-in. B. C., Model 1917, has undergone a satisfactory test at Fort Hancock by the

Ordnance Department. After a service test by Coast Artillery personnel, its suitability as an item for issue will be determined.

DEPRESSION POSITION FINDERS.—On May 28 approval was given for the manufacture of a number of depression position finders designed for use in connection with our longest-range guns. One instrument will be completed first and tested before others are completed.

ANTIAIRCRAFT MACHINE GUN SIGHTS.—Mention was made in the April, 1925, Digest of an intensive development program undertaken that month for the design and manufacture of antiaircraft sights for calibers .30 and .50 machine guns. Work on this project has progressed to the point where a tentative design has been approved and fabrication of twenty-five antiaircraft machine gun sights is in progress. These sights, when completed, will be supplied various Coast Artillery regiments for further tests.

ATWOOD ANTIAIRCRAFT SIGHTS.—Eighteen of the twenty-six Atwood antiaircraft sights, Model 1925E, for the caliber .30 Browning machine gun have been completed and shipped to the 62d Coast Artillery Regiment, Fort Totten, N. Y. The remaining eight sights will be completed and shipped in the next two or three weeks.

MARK III SCOVILL A. A. FUZE.—Mark III Scovill type antiaircraft fuze has been approved as standard for 3-in. A. A. guns in place of the Mark II modified type, previously listed as standard. This change is the result of comparative tests made at the Aberdeen Proving Ground which indicate that the Mark III fuze is superior. The Mark III fuze is also more readily producible since it is almost identical with the 21-sec. combination fuze for mobile artillery.

The 619th Coast Artillery

By FIRST LIEUT. F. J. SINGER, *619th C. A.*

EDITOR'S NOTE: *The 619th Coast Artillery claims the distinction of being the first reserve regiment to have fired major-caliber armament as a unit. This firing took place at Fort Hancock, New Jersey, on June 24, 1925. Five service rounds were fired at a moving target from a 12-inch rifle mounted on a disappearing carriage at a range of 11,000 yards. Officers of the 619th Coast Artillery had full responsibility for the preparation for firing, execution of the firing, and analysis of the target practice.*

On Sunday, June 14, 1925, ten reserve officers of the 619th C. A. reported at Fort Hancock, New Jersey. Lieut. Col. George O. Hubbard, C. A. C., unit executive officer, was already at the post. We, as reserve officers, were not mutually acquainted and were not certain what the next two weeks had in store. The "unit training" plan for the camp had been discussed during conferences, but we were not certain how well this plan would work out nor how much we would be able to learn from our experiences as officers in a reserve regiment assigned to active duty as a unit at a regular Coast Artillery post. All were agreed that the "unit" plan sounded very practical, and that it would be a fine experience to have command of the regular troops. Some of us, however, not having had such practical experience, did not know to what extent we would be able to fill the places of regular officers whose duties we were about to perform.

The first light on this subject was thrown our way that evening when Col. E. B. Martindale, Jr., the Camp Commander, gave us a smoker. The Colonel told us that we would have full responsibility to function as a unit, and the troops would be transferred temporarily to the 619th C. A. (the regular officers at the post being available to give instruction and advice). Those words were

very significant. They told us what our latitude would be and what was expected of us. Responsibility meant that we must work hard to succeed, and that the success of the camp depended on us, individually and collectively, as officers of the 619th C. A.

Lieut. Col. Hazeltine, who took active command, issued an order stating that the 619th C. A. would function tactically as a battalion, and assigned officers to the staff, to Headquarters battery, and to batteries A, B and D. During the period that followed, the regiment functioned administratively as a regiment but tactically as a battalion. The officers of the 619th C. A. took over the batteries and assumed the responsibilities of the 7th C. A. officers whom they relieved. The training in tactical functions was that of a group command. The administrative work was representative of that carried on in a regiment at a post. Morning reports, ration returns, guard rosters, etc., were filled out.

It was considered that the officers of the 619th C. A. carried on the training successfully. We received many helpful suggestions and good advice from Lieut. Col. Hubbard and excellent cooperation and assistance from the officers and enlisted men at the post. There was plenty of work to do and plenty of chance to get excellent practical experience of the kind that would prove most valuable to reserve officers in an emergency. There were numerous minor errors made by the reserve officers in performing the functions but in general everything went very smoothly, and at the end of camp all officers of the 619th were most enthusiastic about the results. All agreed that the "unit training" plan was much to be preferred to the "individual training" plan.

During the fifteen day period there was plenty of artillery drill on the 12-inch rifles mounted on disappearing carriages at Battery Bloomfield. This artillery drill consisted of preparation for and practice in major-caliber firing, and preparation for and practice in sub-caliber firing. During the sub-caliber practice gun No. 2 and a moving target at a range of approximately 3,000 yards were used. For the service practice, gun No. 1 was fired at a moving target at a range of approximately 11,000 yards. During the former practice approximately fifty rounds of sub-caliber were fired, and for service practice five rounds were allowed and fired. Both practices were considered successful.

In addition to the artillery practice, we commanded the troops during infantry ceremonies, inspections, and work in preparation for these. We had a few excellent lectures given by officers of the post and instruction in matters pertaining to artillery and special subjects. We had two nights of searchlight drill and, at the last drill, manned the Fort Command Station and Battery Bloomfield.

On Friday, June 26th, Battery Bloomfield was checked up and turned back. On Friday and Saturday, June 26th and 27th, an analysis of the target practice was made by officers of the 619th C. A., and at 3:00 p. m., Saturday, the critique of the practices was held, officers of the 7th C. A. being present at the critique. The balance of the time at camp was employed in clearing up odds and ends at the batteries and in writing reports on the camp. Regimental headquarters functioned at full capacity in order to complete the general reports and special details.

On Saturday evening and Sunday morning we made final calls upon officers of the post and bade them farewell. We left the post for our respective homes satisfied that the camp had been a big success, and that we had received a splendid training as reserve officers.

Remarks Concerning the Use of Firing-Table Values

By 2D LIEUT. PHILIP SCHWARTZ, O. D.

In order to be able to analyze the results of firings of service batteries satisfactorily, a knowledge of the magnitude of the errors which may occur due to making use of the quantities which are taken from the firing tables or from correction devices is of considerable value. With this in view, a table has been compiled in which the relative accuracy of each quantity has been tabulated; this table is far from *exact*, but it is probably as satisfactory as can be obtained on account of the lack of experimental evidence. It does not represent the official opinion of the Ordnance Department but was compiled by the writer as a result of his experience. The classification is as follows, where Class A = ± 1% approximately, Class B = ± 2% approximately, Class C = ± 5% approximately, Class D = ± 15% approximately, Class E = ± 30% approximately, Class F = ± 50% approximately.

	Quantity	*Class*	*Remarks*
1.	Range (based on given elevation, muzzle velocity and projectile.)	A	Firing-table value based on average of several days firings in a comparatively new gun.
2.	Effect on range of change in elevation.	B	Computed from (1).
3.	Maximum ordinate.	C	No observations; based on theoretical computation.
4.	Terminal velocity.	C	Same as (3).
5.	Angle of fall.	C	Same as (3).
6.	Drift.	B	Same as (1).
7.	Ballistic coefficient.	B	Same as (1).
8.	Probable error in range or deflection.	F	Based on several days firings, but usually only a limited number of rounds each day. This value varies from day to day, depending on gustiness of atmosphere. Varies also with gun and gun crew.
9.	Time of flight.	A	Same as (1).
10.	Angle of site effect on range.	B	Computed from ballistic tables.
11.	Projectile weight effect on range.	E	Based on interior ballistic formulas of doubtful accuracy.
12.	Rotation of earth effect on range and deflection.	C	Computed from ballistic tables.
13.	Muzzle velocity effect on range.	B	Computed from ballistic tables.
14.	Air density effect on range.	B	Computed from ballistic tables.
15.	Air temperature effect on range.	F	Computed; poor air resistance law casts doubt on this value.
16.	Wind effect on range and deflection.	C	Computed from ballistic tables. Formulas used verified recently.
17.	Cant effect on deflection.	—	As accurate as measured cant.
18.	Penetration in armor.	E	Based on empirical approximate formula.

Some other quantities which are used in connection with firing tables and correction devices can be classified as follows:

	Quantity	*Class*	*Remarks*
19.	Powder temperature effect on muzzle velocity.	F	Based on a few doubtful experiments.
20.	Seating, weight of charge, or pressure, effect on muzzle velocity.	E	Based on doubtful interior ballistic formulas.
21.	Erosion of gun, damage to projectile, deterioration of powder with age, moisture in powder, etc.	F	No reliable values.

	Quantity	*Class*	*Remarks*
22.	Jump (vertical or lateral).		Varies considerably with individual gun and carriage.
23.	Ballistic wind measurement.	D	Wind varies from moment to moment. Approximate weighting factors used.
24.	Ballistic density measurement.	D	Requires aeroplane observation of temperature. Approximate weighting factors used.
25.	Air temperature measurement.	D	Same as (24).
26.	Effect of rain and mist upon range and deflection.	—	No reliable values.

The usefulness of this table does not depend upon the accuracy of the numerical value of the percentage attached to any class. It can best be interpreted as meaning, for example, that item 1 of Class A is known about as accurately as item 9 which is in the same class; but it is more accurately known that item 2, 6, 10, 13, or 14 of Class B. Item 8, the probable error, is very inaccurate, and in using this quantity, allowance should be made for a large variation from the firing table value. Item 19, powder temperature effect on velocity, is so inaccurate that it is of considerable importance to keep the powder near its standard temperature in order to avoid large errors due to making use of such a correction. Ballistic investigations now in progress may change the above classification as new results are obtained.

At low elevations where vacuum conditions are approached, the effect of wind and atmosphere is of relatively little importance, the effects of greatest importance being those due to variations in elevation and muzzle velocity. On the other hand at high elevations, where the time of flight is long and where the air acts on the projectile for an appreciable time, the wind and atmosphere effects take on an importance equal to that of variations in the muzzle velocity, while errors in elevation have less effect on range as the elevation approaches 45°. In the case of howitzers the low velocity in use causes vacuum conditions to be approached, errors in muzzle velocity usually being of importance, whereas elevation and air density errors are of less importance. In the case of seacoast mortars, trench mortars and rifle grenades, the low velocity and the relatively heavy projectiles cause vacuum conditions to be approached even for elevations of 45° and above, and errors in velocity are the most probable cause of discrepancies, especially when firing in the lower velocity zones. For all fire above 45° at a fixed range with a given projectile, wind effects become smaller as velocity decreases.

The 544th Coast Artillery

On August 16, 1925, the 544th Coast Artillery (AA) completed its annual tour of duty at Fort Terry, N. Y. The regiment was commanded by Lieut. Col. Walter Bowen Smith, of Providence, R. I. Major Roy S. Atwood, the Executive Officer, accompanied the regiment.

Upon its arrival at camp the regiment immediately established its own headquarters, with all of the regimental staff officers and the sergeant-major functioning. This fact relieved the camp headquarters of much administrative detail and paper work. The 1st Battalion worked almost entirely on the guns, while the 2d Battalion spent its time on the machine guns. During its tour the regiment executed a tactical problem which included the selection of positions and the emplacing of guns.

MILITARY NOTES

furnished by

THE MILITARY INTELLIGENCE DIVISION, G. S.

Great Britain

TERM OF MILITARY SERVICE.—Army service in Great Britain is entirely voluntary, as it is in the United States. The term of enlistment, however, is much longer than in this country, as will be seen in the folowing table:

Corps	*With the Colors years*	*In the Reserve years*
Household Cavalry	8	4
Cavalry of the Line	7	5
Royal Horse Artillery and Royal Field Artillery	6	6
Royal Horse Artillery and Royal Field Artillery (for appointment to Royal Field Artillery only)	3	9
Royal Garrison Artillery	8	4
Royal Engineers:		
Sappers of trades shown in paragraph 7, Appendix II, Regulations for recruiting	3	9
Sappers, all others	6	6
Pioneers	6	6
Drivers	2	10
Men enlisted for appointment as military mechanists	12	Nil.
Railway Reserve	Nil.	6
Foot Guards:		
Men enlisted for appointment as bandsmen	12	Nil.
Other recruits	3	9
Infantry of the Line	7	5
Royal Garrison Artillery, Hong Kong and Singapore Battn.		
West India Regiment	12	Nil.
Army Service Corps:		
Drivers—Horse Transport	2	10
Supply	3	9
Mechanical Transport	7	5
Royal Army Medical Corps	3	9
Royal Malta Artillery	7	5
West African Regiment	6	Nil.
Army Ordnance Corps:		
Armorer and Armament Artificer Sections	12	Nil.
Other Recruits	6	6
Corps of Army Schoolmasters	12	Nil.
Royal Engineers, Hong Kong Company	5	Nil.
Royal Flying Corps, Military Wing	4	4
Boys for Royal Flying Corps, Military Wing for such period as will enable them, after attaining 18 years of age to serve	4	4
Boys for training as clerks, bandsmen, trumpeters, drummers, buglers, or pipers	9	3
Boys for training as tailors or shoemakers	12	Nil.
Boys for training as artificers, all arms other than Royal Flying Corps, Military Wing	12	Nil.

All enlistments in the Territorial Army are for four years.

The age for enlistment and reenlistment for all arms is between 18 and 38 years, except as follows:

(a) Boys between 17 and 18 years of age may enlist with the written consent of their parents.

(b) Men up to the age of 45 years may be enlisted as farriers, fitters, wheelwrights, saddlers, harness makers, cooks, bakers, transport drivers, storemen, or butchers.

(c) Men who have seen service in the Artillery, Engineers, Signal Corps or Naval Volunteer Reserve, and who have had experience in antiaircraft duties, may be enlisted in antiaircraft units up to the age of 45 years, but the number of these men should not exceed fifty per cent of the strength of the organization.

(d) Bandsmen and clerks may be enlisted up to the age of 50 years if they are physically fit for garrison duty overseas.

(e) Boys between the ages of 14 and 17 years may enlist as trumpeters, buglers or bandsmen with the written consent of their parents.

France

System of Promotion.—The present system of promotion in the French Army is interesting as it shows a successful application of the promotion of officers both by seniority and by selection.

Officers are appointed as second lieutenants from the three following sources: sources:

1. Selected noncommissioned officers recommended for commissions.
2. Graduates of the Ecole Polytechnique and Saint Cyr.
3. Noncommissioned student officers of the Saint Maixent and Versailles Schools.

Second lieutenants of all branches are promoted to first lieutenant after two years' service.

Promotion to the grade of captain and major is made partly by selection and partly by seniority. One third of the promotions to captain are by selection and the remaining two-thirds by seniority. For a major, the promotion is half and half.

The promotion of staff officers and to all grades senior to that of major is made exclusively by selection.

No officer, however, can be promoted to a higher grade until he has served the minimum number of years required by law in his grade. This minimum service requirement is, as follows:

2 years as a first or second lieutenant,
4 years as a captain,
3 years as a major,
2 years as a lieutenant colonel,
3 years as a brigadier general.

In time of war, the required service is reduced by half and, in special cases, may be entirely disregarded to reward an act of bravery cited in army orders.

The selection lists of officers of all grades are made up annually, based on the recommendations of chiefs of branches. These lists are the work of selection boards appointed for each arm and service and by a superior commission of

classification which covers all arms and services and which passes on the recommendations of the selection boards.

Infantry selection boards are appointed in each military district or army corps area. They are composed of all general officers commanding infantry units in the area and function under the supervision of the corps area commander.

The other selection boards are general and cover the whole arm or service.

The selection boards draw up the lists of officers to be promoted by selection to the grade of 1st lieutenant, captain and major. They prepare a list of officers whom they recommend be placed on the selection lists for promotion to the grades of lieutenant colonel, colonel and brigadier general.

The superior commission of classification, upon receipt of the recommendations of the area selection boards, draws up the selection lists for the promotion of officers to the ranks of lieutenant colonel and colonel. It classifies colonels and those of equal assimilated rank according to preference and arm of service. It does the same in the case of brigadier generals having less than three years service in that grade. For this classification, the members of the Superior War Council who have charge of the inspection of Army Corps, the Chief of the General Staff of the Army and the president of the selection board (the last in so far as it concerns candidates belonging to his arm) take part in the deliberations of the superior commission. The Superior War Council must give its approval of candidates, whose names are submitted to it by the Minister, for the duties of army corps commander.

The number of candidates to be inscribed on the selection lists or to be presented for each grade is fixed by the Minister before the board meets; the number of officers in each grade, however, must not exceed twice that of the number of vacancies. The number allotted to each area infantry board is determined by the Minister and is in proportion to the number of officers in the area who fulfil the conditions of length of service required for promotion. The lists established by the area boards are afterwards combined into one list for each grade. These lists, arranged by grade and by arm or service, are transmitted to the Minister and constitute the selection lists for the year. The candidates are arranged, in each grade, in order according to length of service in that grade.

Italy

THE CAVALRY SCHOOL.—The Italian Cavalry School, called School of Application for Cavalry, is situated at Pinerolo in northwestern Italy about 25 miles southwest of Turin. Pinerolo is a picturesque medieval town of about 14,000 inhabitants.

The present school is the outgrowth of the "Military School of Equitation" which was founded in 1823 at Venaria Reale, a few miles north of Turin. In 1849 Pinerolo was selected as the site of the new school because of its excellent climate and abundant water and forage supply, in addition to the fact that Venaria Reale was to be turned over to the Artillery. Up until the time of the Franco-Prussian War instruction was given only in equitation and the use of the sabre. After 1870, in addition to the above, a general course of instruction was instituted and has been continued since that time.

In 1825, soon after the opening of the "Military School of Equitation," Otto Wagner, a German, was appointed head of the Department of Horsemanship and remained as such until 1845. Later, Cesare Paderni, an ex-Austrian officer

who had graduated at Vienna, was appointed Chief Instructor, which position be held for thirty years.

Consequently, Italian equitation was based on German and Austrian principles which were followed for many years. In 1894, however, Lieutenant Caprilli, afterwards Captain, developed his system of equitation which proved so successful that in 1902 it was adopted by the Italians. Caphilli may be called the founder of the present day school of Italian equitation which is now so well known.

At the present time the student personnel at Pinerolo is composed of those officers, who, because of the World War, have not previously been able to take the course. In fact the present object of the school is to supplement theoretically the practical knowledge acquired by these student officers during the war, and to enhance their general professional education.

The number of student officers varies from 40 to 60. No quarters are furnished student officers by the government. They rent quarters in the town.

The course at Pinerolo lasts seven months, six months for the course itself and one month for examinations. The courses are both theoretical and practical. Special lectures are delivered on geographical subjects, history and social science, and on any topics of interest that may be selected by the Commandant.

The schedule of instruction is as follows:

Military Art and Field Fortifications:—Length of course, 60 hours.
Communications—Length of course, twenty-five hours.
Department of Weapons—Length of course, forty-five hours.
Topography—Length of course, thirty hours.
Hippology—Length of course, twenty hours.
Geography, Political-Military History, Social Sciences, Physical Education (theoretical part)—Lectures. No examinations.
Motor Transport—Theoretical-practical course. No examination.
Physical Education (practical)—Length of course to be decided by the Commandant.
Hygiene and Administration and other subjects—Length of course to be decided by the Commandant.
Horsemanship—About five hours per day.

At the end of the course the officers must pass an examination.

All students must bring two private mounts in addition to three horses furnished by the school. The majority of school horses are pure bred.

It has been the policy of the Italian Government to permit officers of certain countries to attend the Cavalry School at Pinerolo. In this case the following requirements are made:

(a) The officers must have had sufficient riding experience.

(b) A sufficient knowledge of the Italian language is necessary

COAST ARTILLERY BOARD NOTES

Communications relating to the development or improvement in methods or materiel for the Coast Artillery will be welcome from any member of the Corps or of the service at large. These communications, with models or drawings of devices proposed, may be sent direct to the Coast Artillery Board, Fort Monroe, Virginia, and will receive careful consideration.—R. S. ABERNETHY, *Colonel, C. A. C., President Coast Artillery Board.*

New Projects Initiated During the Month of August

Project No. 380, Radio Equipment for Combat Troops in the Field.—A report of a board of officers convened by the Chief Signal Officer to consider a revision of radio needs for combat troops in the field was referred to the Coast Artillery Board by the Chief of Coast Artillery for remark and recommendation.

Project No. 381, Signal Corps Development Program (Communications Equipment).—The Chief Signal Officer has prepared papers giving the general status of development work undertaken or proposed and an outline of a proposed two-year development program. These papers were referred to the Coast Artillery Board by the Chief of Coast Artillery for remark and recommendation.

Project No. 382, Firing Tables for 3-inch Antiaircraft Gun, Model 1918.—Firing tables for the 3-inch AA Gun, Model 1918, firing AA shrapnel, Mark I, armed with Scovill fuze, Mark III, have been prepared by the Ordnance Department. These were referred to the Coast Artillery Board by the Chief of Coast Artillery for information as to whether or not the tables were in satisfactory form for publication. The Board is making a comprehensive study of the tables and will make recommendations with regard to an improved form for all future antiaircraft firing tables.

Project No. 383, Employment of Repeating Coils on Field Telephone Lines.—The Chief Signal Officer referred to the Chief of Coast Artillery correspondence relating to tests in connection with the employment of repeating coils on field telephone lines, asking that he be informed whether the Coast Artillery desired to participate in the proposed service trials. These papers were referred to the Coast Artillery Board for remark and recommendation. The Coast Artillery Board recommended that four modified repeating coils be furnished for tests in connection with T. I. apparatus, and also for the determination of their possible use with field wire for phantom and simplex circuits.

Project No. 384, Spare Elevating Handwheels for 14-inch Disappearing Carriage, Model 1907 MI.—The Department Ordnance Officer, Panama Ordnance Depot has recommended that the Chief of Ordnance supply additional handwheels for the 14-inch disappearing carriage, Model 1907, MI. This recommendation was made for the purpose of providing a spare elevating handwheel for use

on the left traversing crank, which will enable the azimuth setter to lay the piece in azimuth more quickly and more accurately than can be done with the traversing crank handwheel. The correspondence was referred to the Coast Artillery Board by the Chief of Coast Artillery for remark and recommendation, particular attention to be paid to the cost of these handwheels.

Project No. 385, Confidential.—Not to be published.

Project No. 386, Supple Spotting Board.—Lieutenant Edward Supple, C. A. C., has submitted to the Coast Artillery Board a description of an improved spotting board of the type considered under the heading "Rockwood Spotting Board" in Coast Artillery Board Project No. 173, COAST ARTILLERY JOURNAL, Volume LIX, Page 499. This spotting board is being studied.

Project No. 387, Firing Tables for 1-pounder Subcaliber Tube.—Complete firing tables for the 1-pounder subcaliber tube for 5-inch, 6-inch, 8-inch, 10-inch, 12-inch and 14-inch guns have been prepared by the Ordnance Department. A copy of these tables was referred to the Coast Artillery Board by the Chief of Coast Artillery for information as to whether the tables were in satisfactory form for publication. These tables were recommended as satisfactory.

Project No. 388, Experimental Work with Gas Mask at Coast Artillery Target Practice.—The Commanding General, Ninth Coast Artillery District, directed that the Commanding Officer, Harbor Defenses of San Francisco, report on the basis of the service target practice under gas at Battery Wallace recommendations concerning: (a) the suitability of the present diaphragm gags mask for the fire control section of a Coast Artillery battery, (b) the suitability of the gas mask furnished, for use with optical instruments, (c) the possibility that some of the men in the fire control section have duties such that they can not wear a gas mask, (d) the possibility that some of the men in the gun and ammunition sections have duties such that they can not wear a gas mask, (e) the effect on the rate and accuracy of firing, caused by having the battery personnel wear the latest type of gas masks. The report was referred by the Chief of Coast Artillery to the Coast Artillery Board for remark.

Project No. 389, Repeat-back System for 60-inch Mobile Searchlight Unit.—The Chief of Engineers requested that the Chief of Coast Artillery make recommendations concerning specifications and arrangement drawings covering the installation of an experimental system for the 60-inch mobile searchlight, Model 1925. The Chief of Coast Artillery referred this communication to the Coast Artillery Board and the Board concluded that the development of the equipment described was desirable.

Project No. 390, Predicting Targ Setforward Device.—Captain A. M. Jackson, Coast Artillery Corps, has designed a targ which replaces the usual standard targ and eliminates some of the steps in predicting the setforward point. A special setforward ruler is used in conjunction with this targ. The Chief of Coast Artillery directed that the Coast Artillery Board make a study of the target practice report in which these devices were used. The conclusions of the Coast Artillery Board were that neither the predicting targ nor the setforward ruler meets the requirements of fire control instruments for Coast Artillery use, but that these devices may be satisfactory in special instances.

BOOK REVIEWS

Famous American Naval Officers. By Charles Lee Lewis. L. C. Page & Co., Boston. 1924. 5½"x 8". 374 pp. Ill. $2.00.

A record of the important events in the development of the United States Navy chronicled in sketches of its most famous officers. This method of presenting such a history has many advantages, one being that it attracts and holds the interest of the reader. It also tends to mark out boldly, step by step, the development of the navy. It is written primarily for the American youth. In its pages we find a record of the achievements not only of the officers who have been outstanding in American naval battles, but also of the able officers such as Mahan and Peary, who through long periods of peace exerted a powerful influence toward developing an efficient Navy. Beginning with John Paul Jones and the American Revolution and closing with William Sowden Sims and the World War, the author presents a book particularly worth while to those who wish to get in brief and essentials of our naval development.—C. S. H.

A Year of Prophesying. By H. G. Wells. The MacMillan Company, New York. 1925. 5½"x 7¾". 352 pp. $2.00.

A new book by H. G. Wells is an event to his countless admirers. This is his twenty-ninth book and it will not lack for an audience. This is due primarily to his powers of imagination and his lucid style. *A Year of Prophesying* is a collection of fifty-five articles which appeared weekly in England. They cover many and varied subjects: our clothes, our houses, our amusements, our ways of trading, our laws, our politics, the British Empire, the American Constitution, Lenine, China, India, Fascism, France's attitude toward Germany and the League of Nations.

Each chapter is from five to eight pages and complete in itself, thus making a delightful book to have for reading at spare moments.

In the final chapter the author almost writes a review of the book. To quote him:

> I think most of the clothes ugly and dirty, most of the food bad, the houses wretched, the schools starved and feeble, the amusements dull, the monetary methods silly, our ways of trading base and wasteful, our methods of production piecemeal and wasteful, our political arrangements solemnly idiotic. Most of my activities have been to get my soul and something of my body out of the customs, outlook, boredoms, and contaminations of the current phase of life.
>
> My imagination takes refuge from the slums of today in a world like a great garden, various, orderly, lovingly cared-for, dangerous still but no longer dismal, secure from dull and base necessities. I have come

to believe in the complete possibility of such a world, and to realize the broad lines upon which we can work for its attainment through a great extension of the scientific spirit to the mental field, and through a deliberate reconstruction of social and economic life upon the framework for a new far-reaching educational organization. By projecting my mind forward to that greater civilization I do succeed in throwing a veil of unreality over the solemn ineptitude of today and the complete identification of myself and my insufficiencies and disappointments with the quality of common things. By insisting that I can be a creative revolutionary I escape from acquiescence in what I am and what things are. To live under the rule of King George or President Coolidge and under the sway of current customs, habits and usages, can be made tolerable by the recognition of their essential transitoriness and their ultimate insignificance. And in no other way can it be made tolerable to anyone with a sense of beauty and a passion for real living.—W. W. I.

Blockade and Sea Power. By Maurice Parmelee. Thomas Y. Crowell Co., New York. 1924. 5½"x 8". 449 pp. $3.00.

In this volume Mr. Parmelee presents an interesting and valuable work. His historical account is as impartial as it is authoritative, and, whether or not one agrees with his opinions concerning a World State and the conclusions he draws, one finds them original and stimulating.

In part I the author gives an impartial account of the outstanding features of the blockade of 1914-1919—its beginnings, its effects upon the German people and upon neutrals, and its final importance in the winning of the war. He discusses the violations of international law committed by both sides in conducting their blockades, and he points out that the German people regarded the starvation blockade conducted by the Allies as much an atrocity as the Allies considered unrestricted submarine warfare.

In conclusion, the author emphasizes: (1) That the general retreat of the German Army in 1918 was due largely to the lack of guns and munitions of war, which, with the supply of raw materials cut off by the blockade, could no longer be replaced when worn out or exhausted; and (2) That with half a million tons of allied and neutral shipping being sunk in a month, had the unrestricted submarine warfare of Germany not been checked when it was, Germany would have won.

In the opening chapters of Part II the author touches upon the great underlying causes, economic and imperialistic, responsible for wars and forming the great problems to be solved by any world state of the future, since they will be its excuse for existence. Only once does he desert his somewhat detached attitude, this in an impassioned harangue against the principle, "In time of peace, prepapre for war." He argues that the possession of a strong and efficient army and navy begets a temptation to use them, and puts his arguments strongly and convincingly, citing the case of Germany in the World War in refutation of the axiom that a strong defense compels peace. His statement that "the struggle for export trade was one of the principal causes of the late war," is especially provocative, and he arrives at the conclusion that a World State is the answer to these questions in a highly convincing manner.

The essential features of a World State are outlined, among them being, abolition of absolute national sovereignty, complete national disarmament to police protection strength, and abolition of all discriminatory tariffs, etc. Having outlined an ideal World State, he contrasts the present League of Nations, point by point, with other proposed schemes in a manner highly derogatory to the League

in its present form. He emphasizes the fact that the League of Nations is no true example of a World State at all, being part of a victor's treaty and designed for the victor's especial benefit, and calls it, with a pertinently expressive sarcasm, the "League of the Entente Allies."

In conclusion he admits that a capitalistic social order with its attendant, often unscrupulous, trade rivalries is probably so inimical to the success of a World State as to be an insuperable obstacle, and that, above all, be the formation of a World State ever so desirable and the opportunities never so great, as long as men are men, men will fight.—A. B. N.

The Military Side of Japanese Life. By Captain M. D. Kennedy. Houghton Mifflin Co., Boston. 1925. 6″x 8¾″. 367 pp. $5.00.

This volume is described on the jacket as "***not a book of propaganda but a fascinating study of Japanese life written in a vigorous style***." The style is informal, almost naive, and chatty rather than vigorous. The book is sometimes interesting, sometimes tedious, sometimes a study of racial psychology, and sometimes, despite the writer's best efforts, a more or less inconsequential travel book.

As a student of the Japanese people the writer is persistently friendly without being fulsome and without losing entirely the judicial attitude. He misses no opportunity to point out that much of the feeling against the Japanese is due to mutual lack of comprehension and that there is not sufficient justification for the fact that many Europeans and Americans like the Chinese much better than the Japanese.

The reader cannot but be impressed with the special attention given the "training in moral" or "Seishin Kyoiku" with the religious and semi-religious ceremonies, the visits to national religious shrines and to heroes' tombs, these and frequent lectures. When one considers the hard work, simple fare, bare quarters, and particularly, the exposure lightly clothed to the elements by which the idea is inculcated that simplicity, frugality and ability to withstand hardship are among the principal military virtues, one is quite apt to make mental comparisons with the not infrequent complaint of the warmly dressed, well fed American soldier in France, and particularly of some of his politician friends.

The work of the Japanese Army includes the upbuilding of patriotism in the civil population. Captain Kennedy draws an interesting picture of the visit of a regiment to a country village, and of the friendliness, esteem and hospitality of the villagers.

Captain Kennedy attended the grand maneuvers in 1918, 1919 and 1920. His observations may be summarized as follows. The Japanese soldier has very high morale and wonderful endurance. The cavalry is poor, the infantry excellent, and capable of almost incredible marches. The equipment and tactics are not modern but antedate the World War. Aviation is in a backward state, but improving under the French Aviation Mission. In adopting post-war tactics and equipment, the Japanese are proceeding slowly but their commissions are keeping in touch with the great military nations. It is expected that modernization in all respects will be completed by 1940.

The author gives but a general outline of the Japanese military organization and system of military education. With regard to Japanese fighting qualities, Captain Kennedy believes the discipline of the Army is such as not to justify the belief of many Japanese that, in case of a defeat, the reaction from present Japanese overconfidence may lead to disaster.

While Captain Kennedy's book cannot claim to be a deep study of Japanese military organization, equipment or methods, or of military or racial psychology, it should be an exceptionally useful guide to the "Foreign Language Officer" and is worth-while reading to the American officer for its "close ups" of the military life of a friendly nation.—R. S. A.

Military Intelligence (A New Weapon in War). By Walter C. Sweeney, Lieut. Colonel, U. S. Army. Frederick C. Stokes & Co., New York. 1924. 5½"x 7¾". 259 pp. $2.50.

This is a most valuable work on this subject, and one of the first to be published by an American author. Few men in the United States are more fitted to discuss the subject than the author, as his experience and training has eminently fitted him as an expert.

The World War provided the proof that a struggle between nations had grown out of the narrow limits of decision by arms, and had become a contest in which the whole national strength was engaged on the political, economic and military territories and, last but not least, even in the very soul of the peoples engaged; therefore, the old idea of a purely military intelligence was expanded to include the political, economic and even morale features of intelligence.

This book gives, in perhaps too much detail, the organization and growth of our Military Intelligence, and ably convinces the reader of the value of such a service and its use to our country in war. It shows that Intelligence, like any other new product, must be sold to the consumer, the army as a whole, and in the earlier stages of the war, that was somewhat difficult, but the difficulty lessened as the war progressed, especially purely combat intelligence.

The chapters deal with the Development, the Definition and Organization of Military Intelligence; the problems of Modern War; the Intelligence Service in the World War; the Functions of Personnel; the Collection, Dissemination and Evaluation of Intelligence; Secret Service; Maps and Censorship; and the qualities requisite in an Intelligence Officer.

This book is of general value to all officers of the Army and of special value to the general public, as it is the only authoritative source of information available on this subject.—W. W. H.

The History of Munitions Supply in Canada, 1914-1918. By David Carnegie. Longmans, Green & Co., New York. 1925. 6"x 9". 336 pp. Ill. $6.00.

In 1914 Canada was considered so incapable of supplying powder and shell in quantity that Great Britain requested the Canadian authorities to negotiate with the United States Steel Co. and other manufacturers to obtain ammunition for her. The efforts required by a purely agricultural country to commence the manufacture of materials of war such as ammunition, lumber, airplanes, and ships are related in this book. "The object of this story is to record and preserve accurate and interesting facts of a remarkable achievement by Canadians upon which the statistician may rely and of which the Empire may be justly proud."

Under the leadership and due to the initiative of General Sir Sam Hughes, the Canadian Minister of Militia, a "Shell Committee" was formed which acted as the agent of the British Government in obtaining military supplies in Canada. By the end of the War, this Committee, reorganized into an "Imperial

Munitions Board," "had provided between a quarter and a third of all the shells used by the British Army." In addition, it provided other war materials, expending over $1,500,000,000 in the process. Problems of organization, manufacture, personnel, inspection and transportation had to be met and solved before this record was made possible. The history of the methods adopted in solving these problems and of the results obtained is told in detail in this book.

The author was the Ordnance advisor of the Committee and of the Board. A foreword is contributed by David Lloyd George, the first Minister of Munitions of England.—P. S.

Our Foreign Affairs. By Paul Scott Mowrer. E. P. Dutton & Co., New York. 1924. 5¾"x 8½". 348 pp. $3.50.

Here is another volume in the group of works dealing with our national political affairs that has been reviewed recently in the JOURNAL. This, however, deals primarily with our foreign relations although, in developing this subject, there is necessarily considerable discussion of internal condition and affairs.

The author points out that the international position of the United States has undergone a great change in recent years, that her interests have broadened, that her influence is greater, and that these changes require the careful consideration and determination of her foreign policy and conduct of her foreign affairs. From his preface "My whole aim is, first to set forth our new situation, correcting certain misapprehensions both as to public opinion and as to diplomacy; second, to stimulate interested individuals to think about general aspects of foreign policy for themselves; and, finally, to show them how to go about this thinking, or this study, easily, scientifically. In short, what I have to present is rather a method than a doctrine." This, then, is the substance of the book. It remains merely to say that this substance has been carefully developed. The text brings into focus events from out of the background of our country's history and from them forms clear images of her foreign policies. The reviewer believes that Mr. Mowrer has accomplished his aim; and recommends this book as one with whose contents each officer may well be familiar.—C. D. Y. O.

The Call of The Congo. By Herbert Smith. Powell & White, Cincinnati. 1924. 5"x 7½". 267 pp. Ill. $1.25.

Story by a Christian missionary in Belgian Congo, devoted largely to a study of the natives, their mode of life, customs, traits of character, superstitions. —C. S. H.

Far Harbors Around the World. By Hubbard Hutchinson. G. P. Putnam's Son's, New York. 1924. 6¼"x 9¼". Ill. 324 pp. $3.75.

If any army officer intends to postpone his foreign service tour let him beware of this book, for having read it, he will be eager to start at once.

The author takes you away from the tourists' trodden path and to out-of-the-way and unusual places. With him you climb to the watch towers of the great Wall of China, or gaze at the Southern Cross from a moon-lit deck on tropic seas.

If you wish to take a voyage *de luxe,* having already decided against foreign service, get a copy of this book, an easy chair and be off to the land of your dreams.—L. M. C.

Putnam's Ready Speech Maker. By Edwin Hamlin Carr. G. P. Putnam's Sons, New York. 1922. 5¼"x 7½". 283 pp.

The sub-title of this work aptly sums up its contents—What to Say and How to Say It.

One section of the book is devoted to general suggestions for speakers, covering etiquette for the speaker, procedure on special occasions, methods of training the memory, and the mechanics of speaking.

Another section outlines in detail two methods of home training in the preparation of a speech. Other sections treat of the speaker at his task and provide materials for use in preparing speeches.

This book should be of considerable value not only to those who do not understand the art of preparing and delivering speeches, but to competent and experienced speakers as well.—R. D.

Japan From Within. By J. Ingram Bryan, M. A., M. Litt., Ph. D. Frederick A. Stokes Co., New York. 1924. 5½"x 8½". 288 pp. $4.50.

This book destroys the belief that it is impossible to understand the Oriental, for the author shows how, by intensive study, one may not only understand but also appreciate Japanese institutions and civilization.

From a survey of Japan's relation to the Asian continent we are given a description of her government; an account of her industries and manufacturers together with her commerce, trade and banking; agriculture and forestry are given attention; and the fact is noted that she has not yet solved her labor problem.

The chapters relating to her Army and Navy will be of particular interest to men of the service, while the one on Arts and Crafts can not fail to interest all readers. The last chapter, "The Future of Japan," is a comprehensive survey of Japan's position and a statement of her policy.

This is undoubtedly the most concise and authoritative book to be had on Japan.—L. M. C.

Fortresses are equally useful in offensive and defensive warfare. It is true they will not in themselves arrest an army, but they are an excellent means of retarding, embarrassing, weakening, and annoying a victorious enemy.—*Napoleon.*